SA810/860 Single/Double-Sided Half-Height Diskette Storage Drives

OEM Manual

Shugart

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT.)

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS / MNEMONICS

AM Address Mark

CRC Cyclic Redundancy Check

CRT Cathode-ray Tube

DS Drive Select

FM Frequency Modulation

ID Index

LED Light Emitting Diode

MFM Modified FM

MLC Machine Level Code

PCB Printed Circuit Board

PLL Phase Locked Loop

SEP Separated

VFO Variable Frequency Oscillator

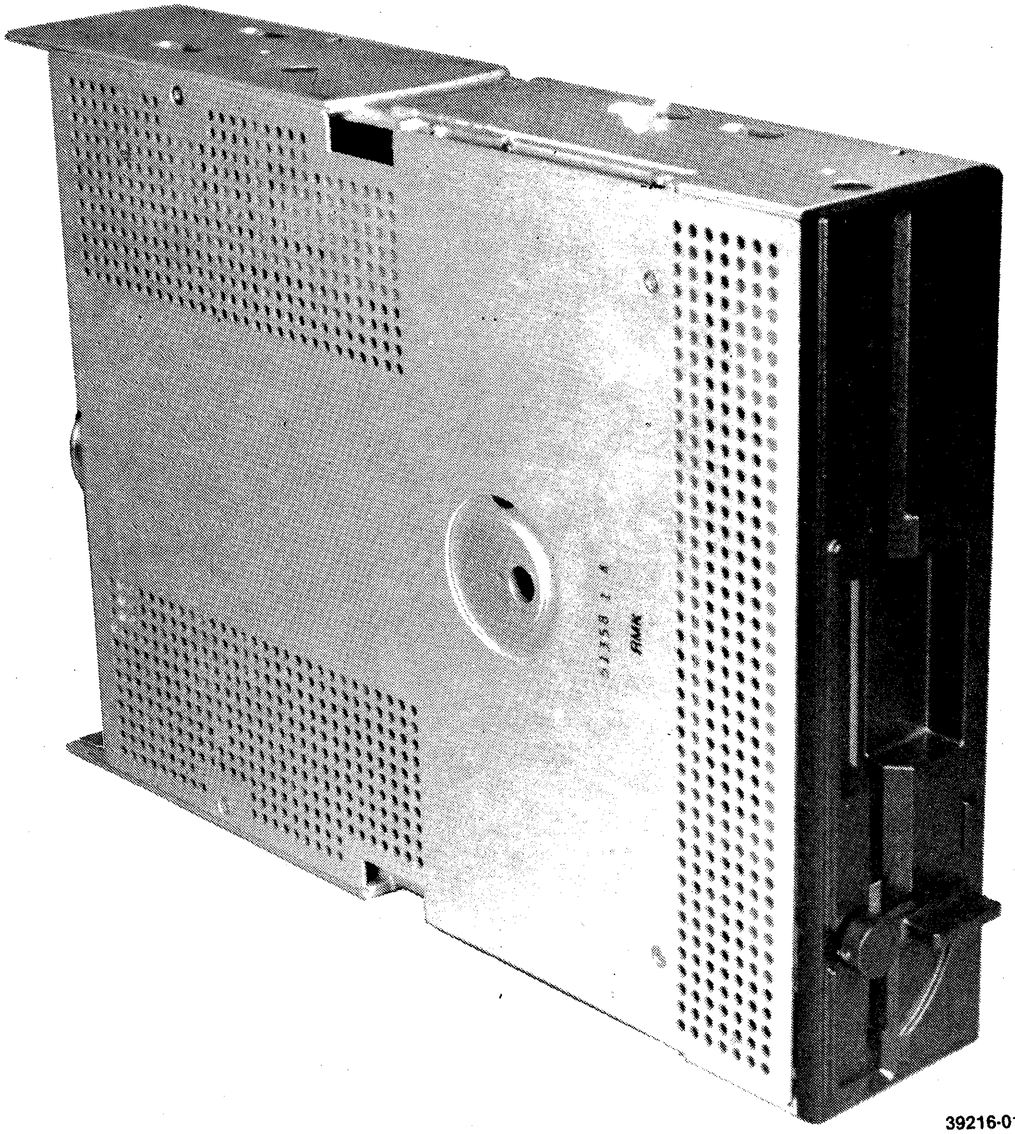
WG Write Gate

ABOUT THIS MANUAL

This manual (P/N 39216-2) supersedes all earlier manuals. All earlier editions may be discarded.

While every effort has been made to ensure that the information provided herein is correct, please notify us in the event of an error or inconsistency. Direct any comments on the form at the back of this manual to:

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39216-01

FIGURE 1-1. SA810/860 HALF-HEIGHT FLOPPY DISK DRIVE

SECTION I
INTRODUCTION

1.1 GENERAL DESCRIPTION

The compact SA810 single-sided and SA860 double-sided half-height 8-inch floppy disk drives offer a reliable, low cost, high performance solution for OEM data storage applications which require maximum capacity in the smallest space possible. The SA810/860 drives are half the height of the Shugart SA801 floppy disk drive, fit in comfortably with a CRT, require no ac voltage, and offer up to 1.6 megabytes of unformatted capacity.

The SA810/860 offers the following standard features:

a. Half-height sizing: 2.31 in. (59 mm) high by 8.55 in. (217 mm) wide by 12.00 in. (305 mm) deep
b. Interface and media compatibility with Shugart SA801/851 disk drives
c. Low heat dissipation
d. Fast access time (3 ms track to track)
e. Quiet operation
f. Low media wear due to low mass head
g. Rapid start dc drive motor--less than one revolution (eliminates ac requirements)
h. Phase-Locked Loop Crystal Referenced Motor Speed Control
i. Media compatible with SA801/851 plus IBM 3740
j. Single or double density
k. 0.8/1.6M Bytes (unformatted capacity)
l. Write protect and programmable door lock for improved data security
m. Internal write current switching
n. TRUE READY alerts the system that the drive is ready to send or receive data
o. Buffered seek
p. Single or multiple drive dc Motor On control
q. Multiple jumper options
r. Shugart's proprietary Bi-Compliant read/write heads with straddle erase elements
s. Extended reliability
t. Activity light
u. Solid die cast chassis
v. Light weight
w. Inline dc and I/O connectors

The SA810/860 provides the best solution to the user looking for a compact, low cost, and reliable 8-inch floppy disk drive. The SA810/860 is the most versatile disk drive on the market. This drive is backed by an engineering department that is recognized as the largest, most experienced group in the entire floppy industry. The SA810/860 is the ultimate solution for small business systems, intelligent terminals, personal computer systems, and program storage equipment.

1.2 SPECIFICATIONS SUMMARY

1.2.1 Performance Specifications

	SA810 Single/Double Density	SA860 Single/Double Density
Capacity		
Unformatted		
Per Disk	400/800 k bytes	0.8/1.6 M bytes
Per Surface	400/800 k bytes	400/800 k bytes
Per Track	5.2/10.4 k bytes	5.2/10.4 k bytes

	SA810 Single/Double Density	SA860 Single/Double Density
IBM Format		
(128 byte sectors)		
Per Disk	250/500 k bytes	500/1000 k bytes
Per Surface	250/500 k bytes	250/500 k bytes
Per Track	3.3/6.66 k bytes	3.3/6.66 k bytes
Transfer Rate	250/500 k bits/sec	250/500 k bits/sec
Latency (average)	83 ms	83 ms
Access Time		
Track to Track	3 ms	3 ms
Settle Time	13 ms	13 ms
One Track Seek & Settle	16 ms	16 ms
Average (including settle)	89 ms	89 ms
Motor Start Time		
Worst Case	165 ms	165 ms
Typical	120 ms	120 ms

1.2.2 Functional Specifications

Rotational Speed	360 rpm	360 rpm
Recording Density (inside track)	3268/6536 bpi	3408/6816 bpi
Flux Density	6536 fci	6816 fci
Track Density	48 tpi	48 tpi
Tracks	77	154
Index	1	1
Encoding Method	FM/MFM	FM/MFM
Media Requirements		
Soft Sectored	SA100/102	SA150
32 Sector Hard Sectored	SA101/103	SA151
Alignment Diskette	SA120	SA122

1.2.3 Physical Specifications

Environmental Limits	Operating	Shipping
Ambient Temperature:	50° to 115°F (9.9° to 46.1°C)	-40° to 144°F (-40° to 62.2°C)
Relative Humidity:	20% to 80%	1% to 95%
Maximum Wet Bulb:	85°F (29.4°C)	no condensation

Storage

-8° to 122°F (-22.2° to 50°C)
1% to 95%
no condensation

DC Voltage Requirements:

+24.00 ± 2.4 V dc @ 1.0 A typ, 1.7 A max., 100 mV ripple.
+5.00 ± 0.25 V dc @ 0.7 A typ, 1.0 A max., 50 mV ripple.

NOTE

If the stepper motor is energized by the controller during the single motor start-up time, the drive will exceed the +24 V dc current specification of 1.7 A maximum. Under this condition, the current specification is 2.2 A maximum.

Mechanical Dimensions
Width = 8.55 in (217 mm)
Height = 2.31 in (59 mm)
Depth = 12.00 in (305 mm)
Weight = 7 lbs (3 kg)

Mounting
Top loading
Diskette Horizontal Label Up/Down
Diskette Vertical Label Left/Right

Power Dissipation:
10 watts (34 BTU/hr) Standby
28 watts (96 BTU/hr) Typical
50 watts (171 BTU/hr) Maximum

1.2.4 Reliability Specifications

Mean Time Between Failure: 10,000 Power On Hours under typical usage.
Preventive Maintenance: Not required.
Mean Time to Repair: 30 Minutes
Component Life: 5 years
Error Rates:

Soft Read Errors:	1 per 10^9 bits read
Hard Read Errors:	1 per 10^{12} bits read
Seek Errors:	1 per 10^6 seeks

Media Life:
Passes per Track: 3.5×10^6
Insertions: 30,000 +

1.3 FUNCTIONAL CHARACTERISTICS

The 810/860 floppy disk drives consist of:

a. Read/Write and Control Electronics
b. Drive Mechanism
c. Precision Track Positioning Mechanism
d. Read/Write Head(s)

1.3.1 Electronics

The electronics are packaged on one PCB which contains:

a. Index Detector Circuits (Sector/Index for Hard Sectored Media)
b. Head Position Actuator Driver
c. Read/Write Amplifier and Transition Detector
d. Write Protect
e. Drive Select Circuits
f. Spindle Motor Control
g. Data/Clock Separation Circuits (FM Only)
h. Drive Ready Detector Circuit
i. Drive True Ready Detector Circuit
j. Side Select Circuit (Used on SA860 only)
k. In Use and Door Lock Circuits
l. Internal and External Write Current Switching
m. Power On Reset Circuit
n. Activity LED

1.3.2 Drive Mechanism

The Head Positioning Actuator moves the read/write head(s) to the desired track on the diskette. The head(s) is loaded onto the diskette when the door knob is closed. If no diskette is inserted when the door knob is closed, the heads will not touch each other.

The dc drive motor under phase locked loop speed control (using an integral tachometer) rotates the spindle at 360 rpm. A contracting collet/spindle assembly provides precision media positioning and clamping to ensure data interchange. A diskette ejector places the diskette within reach of the operator when the diskette is unclamped.

1.3.3 Positioning Mechanism

The read/write head assembly is accurately positioned through the use of a precision HeliCam V-groove lead screw with a flat nut follower which is attached to the head carriage assembly. Precise track location is accomplished as the lead screw is rotated in discrete increments by a stepper motor.

1.3.4 Read/Write Heads

The proprietary head(s) is a single element ceramic read/write head with straddle erase elements to provide erased areas between data tracks. Thus, normal interchange tolerances between media and drives will not degrade the signal to noise ratio and diskette interchangeability is ensured.

The read/write head(s) is mounted on a carriage which is located on precision carriage ways. The diskette is held in a plane perpendicular to the read/write head(s) by a platen located on the base casting. This precise registration assures perfect compliance with the read/write head(s). The read/write head(s) is in direct contact with the diskette. The head surfaces have been designed to obtain maximum signal transfer to and from the magnetic surface of the diskette with minimum head/diskette wear due to the low mass suspension system.

1.3.5 Recording Formats

The format of the data recorded on the diskette is totally a function of the host system. This format can be designed around the user's application to take maximum advantage of the total available bits that can be written on any one track.

Figure 1-2 provides a functional diagram of the SA810/860. For a detailed discussion of the various recording formats, refer to Section VI.

1.4 FUNCTIONAL OPERATIONS

1.4.1 Power Sequencing

Applying dc power to the SA810 or SA860 can be done in any sequence; however, during power up, the WRITE GATE line must be held inactive or at a high level. After application of dc power, a 90 ms delay should be introduced before a seek operation or before the control output signals are valid. After powering on, the initial position of the read/write heads with respect to the data tracks on the media is indeterminant. In order to assure proper positioning of the read/write heads after power on and internal write current switching at the proper track, a STEP OUT operation should be performed until the TRACK 00 line becomes active (recalibrate).

1.4.2 Drive Selection

Drive selection occurs when the DRIVE SELECT line in the drive is activated. Only the drive with this line active will respond to input lines or gate output lines. Under normal operation, the DRIVE SELECT line enables the input and output lines, starts the spindle motor, locks the door, and lights the Activity LED on the front of the drive.

1.4.3 Motor On

In order for the host system to read or write data, the dc drive motor must be turned on. In the standard configuration, this is accomplished by activating the line DRIVE SELECT. A 165 ms delay must be introduced after activating this line (or the TRUE READY line may be monitored) to allow the motor to come up to speed before reading or writing can be accomplished. All motors in a daisy chain configuration can be turned on with the optional MOTOR ON line or the spindle motor may be activated when both MOTOR ON and DRIVE SELECT are present. Refer to paragraphs 7.8 and 7.9.

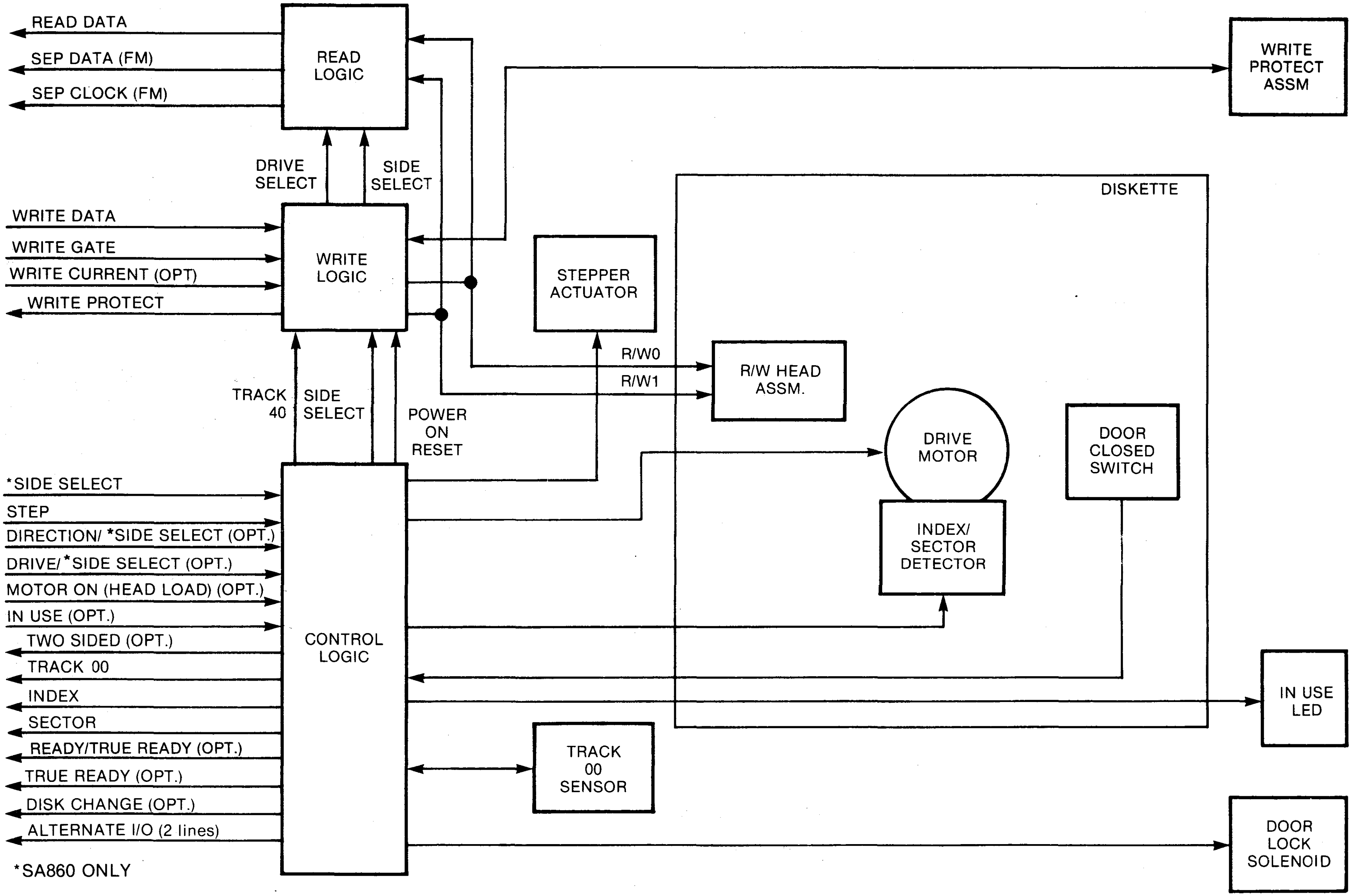


FIGURE 1-2. SA810/860 FUNCTIONAL DIAGRAM

In the standard configuration, the host system turns off the motor by deactivating the DRIVE SELECT line. This should be done if the drive has not received a new command within 2.6 seconds (16 revolutions of diskette) after completing the execution of a command. This will ensure maximum motor and media life. Also, the 2.6 second delay function can be done by the drive by jumpering the optional Motor Off delay. Refer to paragraph 7.10.

1.4.4 Track Accessing

Seeking the read/write heads from one track to another is accomplished by:

a. Activating DRIVE SELECT line.

b. Selecting desired direction utilizing DIRECTION SELECT line.

c. WRITE GATE being inactive.

d. Pulsing the STEP line.

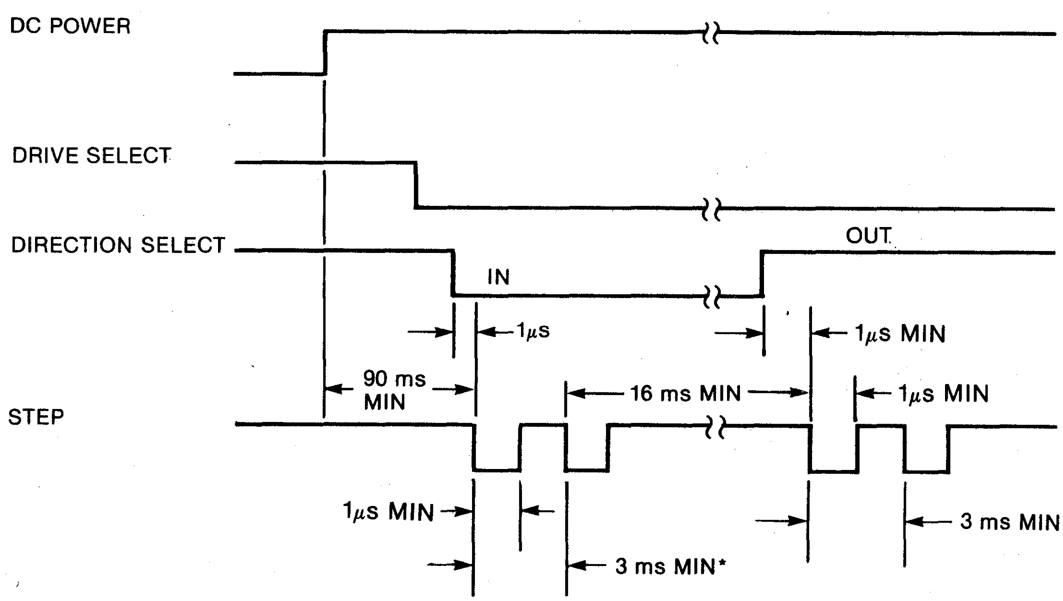
Multiple track accessing is accomplished by repeated pulsing of the STEP line until the desired number of steps have been input. Each pulse on the STEP line will cause the read/write heads to move one track either in or out depending on the DIRECTION SELECT line. Head movement is initiated on the leading edge of the STEP pulse. Pulses received at less than a 3 ms period, but greater than 15 μs, will be stored in a buffer which will then issue step commands to the drive stepper motor at a 3 ms pulse rate. Pulses received at greater than a 3 ms period will step the drive at the same rate they are received. The first step begins upon receipt of the first step pulse.

1.4.5 Step Out

With the DIRECTION SELECT line at a plus logic level (2.5 V to 5.25 V), a pulse on the STEP line will cause the read/write head(s) to move one track away from the center of the disk. The pulse(s) applied to the STEP line must have the timing characteristics shown in figure 1-3 or figure 1-4.

1.4.6 Step In

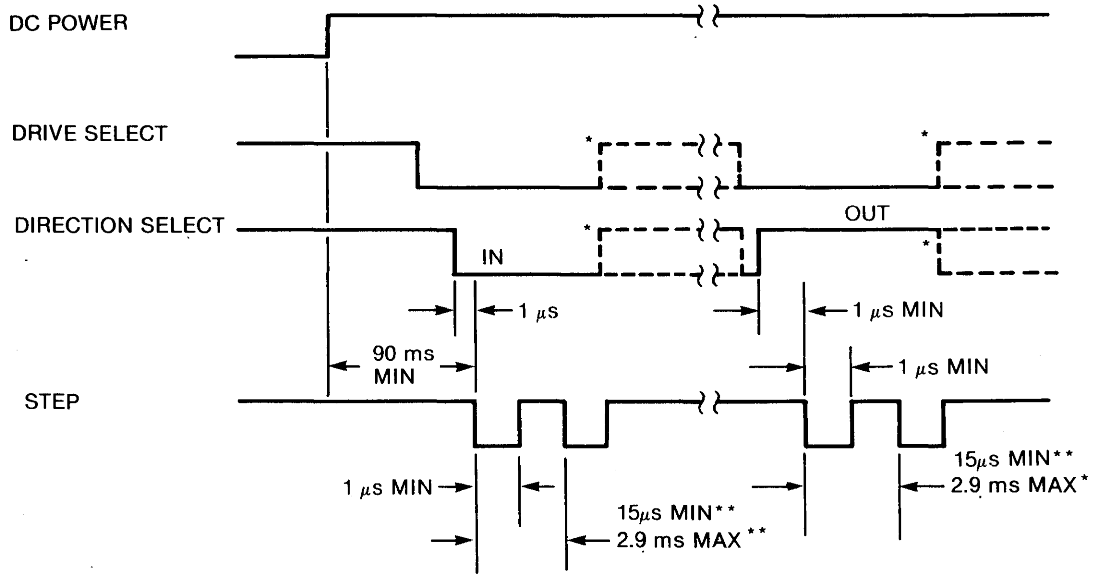
With the DIRECTION SELECT line at a minus logic level (0 V to 0.4 V), a pulse on the STEP line will cause the read/write heads to move one track closer to the center of the disk. The pulse(s) applied to the STEP line must have the timing characteristics shown in figure 1-3 or figure 1-4.



*3 ms is the minimum frequency for a standard seek. Pulses received at less than a 3 ms frequency will go into a buffered seek mode. See figure 1-4.

39216-03-A

FIGURE 1-3. TRACK ACCESS TIMING, STANDARD SEEK



*After the last step pulse has been issued the drive may be deselected. The drive ignores any change to the DIRECTION SELECT line when no further step pulses are received. This frees the controller to issue instructions to other drives while the first drive completes the step commands stored in the buffer.

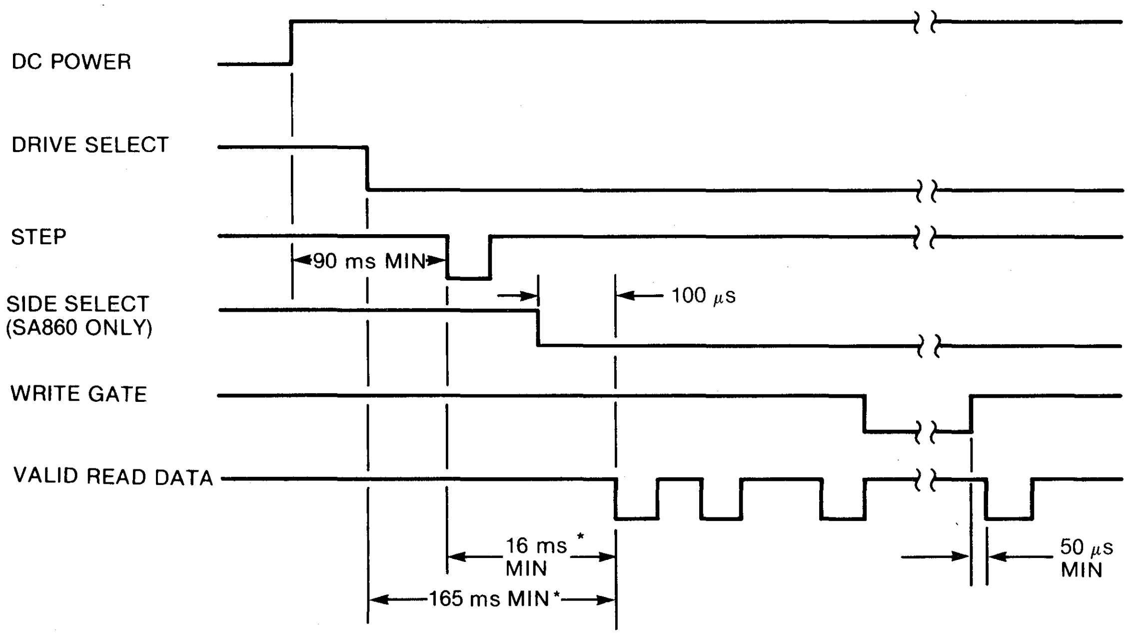
**Pulses received at less than a 3 ms period will be stored in a buffer which will then issue step commands to the drive stepper motor at a 3 ms pulse rate. Pulses received at greater than a 3 ms period will step the drive at the same rate they are received. The first step begins upon receipt of the first step pulse.

39216-31

FIGURE 1-4. TRACK ACCESS TIMING, BUFFERED SEEK

1.4.7 Side Selection (SA860 Only)

Head selection is controlled via the I/O signal line designated SIDE SELECT. A plus logic level on the SIDE SELECT line selects the read/write head on the side 0 surface of the diskette. A minus logic level selects the side 1 read/write head. When switching from one side to the other, a 100 μs delay is required after SIDE SELECT changes state before a read or write operation can be initiated. Figure 1-5 shows the use of SIDE SELECT prior to a read operation.



*Or when TRUE READY comes active.

39216-04

FIGURE 1-5. READ INITIATE TIMING

1.4.8 Read Operation

Reading data from the SA810/860 drive is accomplished by:

a. Activating DRIVE SELECT line.

b. Selecting head (SA860 only).

c. WRITE GATE being inactive.

The timing relationships required to initiate a read sequence are shown in figure 1-5. These timing specifications are required in order to guarantee that the position of the read/write head has stabilized prior to reading. The timing of READ DATA (FM) is shown in figure 1-6.

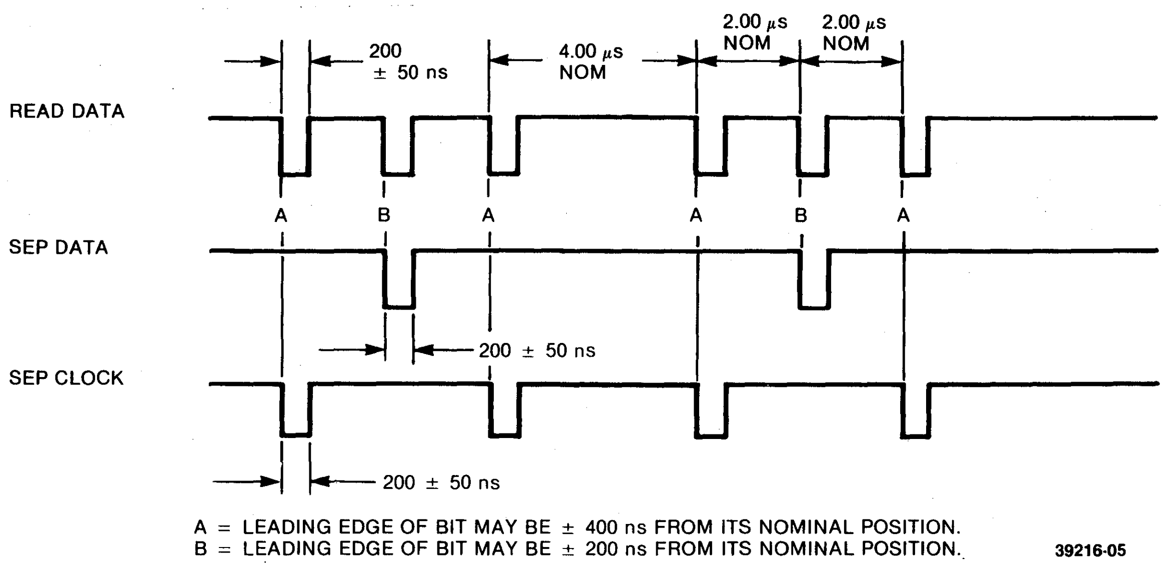


FIGURE 1-6. READ SIGNAL TIMING (FM ENCODING)

The encoding scheme of the recorded data can be FM or MFM. The first of these, FM, provides single-density recording. The superior efficiency of MFM permits the bit cell period to be half that of the FM code, thereby providing double-density recording. Differences among FM and MFM encoding are concerned with the use of clock bits in the write data stream.

FM encoding rules specify a clock bit at the start of every bit cell. MFM encoding rules allow clock bits to be omitted from some bit cells, when either the preceding bit cell or the current bit cell contains a data bit. See figure 1-7.

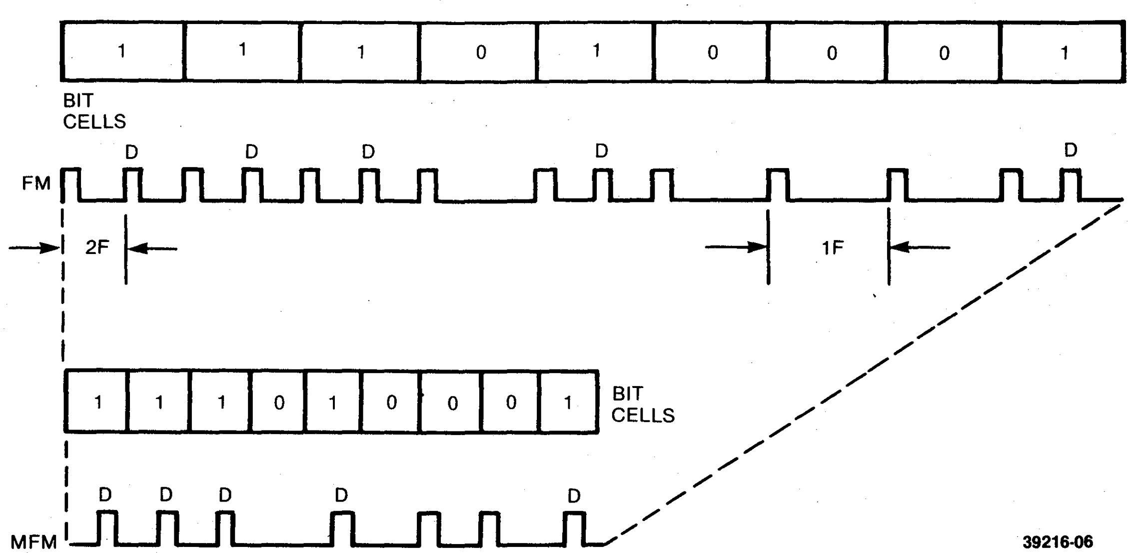


FIGURE 1-7. FM AND MFM CODE COMPARISONS

In both of these encoding schemes, clock bits are written at the start of their respective bit cells and data bits at the center of their bit cells.

The timing of the read signals, READ DATA, SEPARATED DATA, and SEPARATED CLOCK are shown in figure 1-6 (FM encoding).

In the standard SA810/860, data separation of FM data is performed by the drive electronics. Data bits are presented to the controller on the SEP DATA line and clock bits are presented on the SEP CLOCK line. In systems using MFM encoding, data separation is performed outside the drive. In such cases, the READ DATA line carries both clock bits and data bits. Separation of MFM encoded read data should be controlled by a phase-locked loop circuit.

For additional information regarding the use of MFM encoding, refer to paragraph 6.2.

1.4.9 Write Operation

Writing data to the SA810/860 is accomplished by:

a. Activating DRIVE SELECT line.

b. Selecting head.

c. Activating WRITE GATE line.

d. Pulsing WRITE DATA line with data to be written.

e. Head current switching.

The timing relationships required to initiate a write data sequence are shown in figure 1-8. These timing specifications are required in order to guarantee that the read/write head position has stabilized prior to writing.

Write data encoding can be FM or MFM. If MFM is used, the write data should be precompensated to counter the effects of bit shift. The amount and direction of compensation required for any given bit in the data stream depends on the pattern it forms with nearby bits.

For more details regarding data encoding and formatting for SA810/860 drives, refer to Section VI.

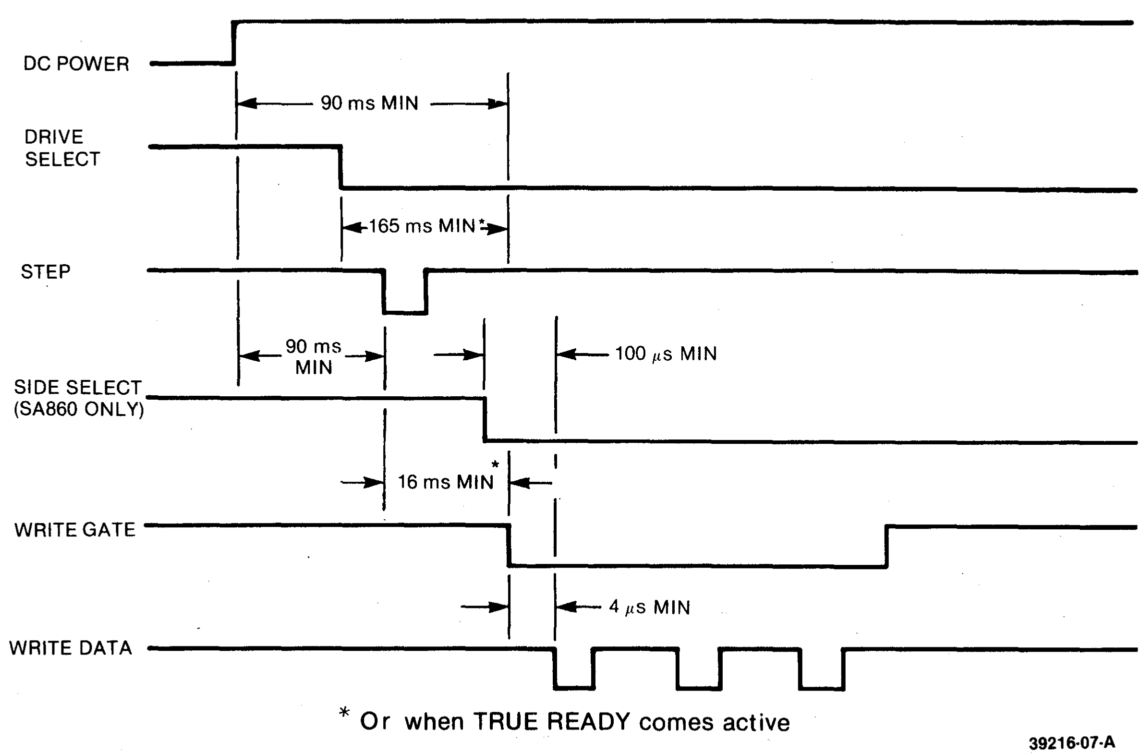
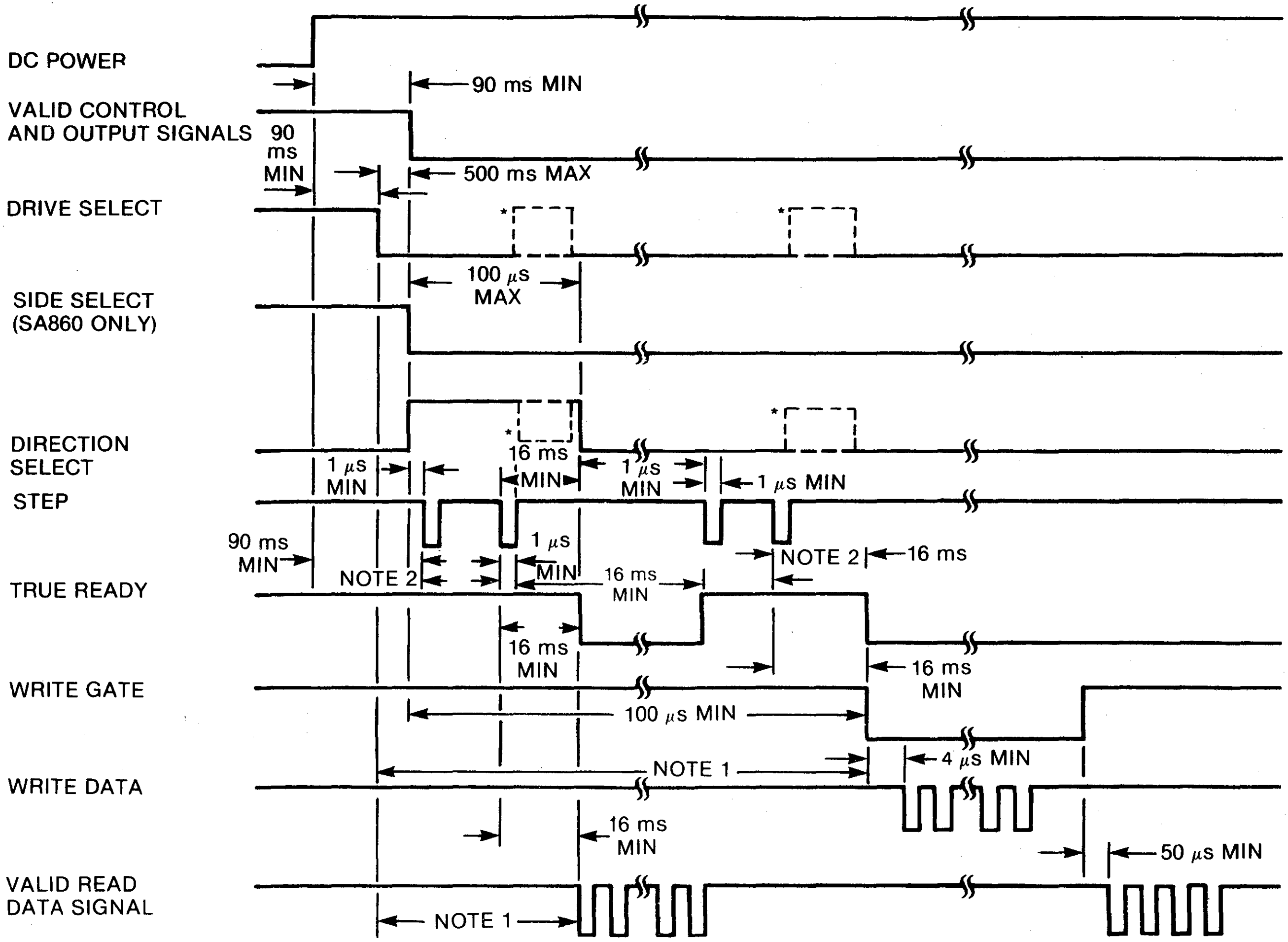


FIGURE 1-8. WRITE INITIATE TIMING

1.4.10 Sequence Of Events

The timing diagram shown in figure 1-9 illustrates the necessary sequence of events with associated timing restrictions for proper operation.



NOTE 1: 165 ms minimum delay must be introduced after DRIVE SELECT to allow time for the dc motor to reach 360 rpm or the optional TRUE READY line must be monitored.

NOTE 2: If performing standard seeks, the minimum frequency is 3 ms between steps. If utilizing the drive in the buffered seek mode of operation the frequency shall be 15 µs to 2.9 ms between pulses.

*After the last step pulse has been issued, the drive may be deselected. The drive ignores any change to the DIRECTION SELECT line when no further step pulses are received. This frees the controller to issue instructions to other drives while the first drive completes the step commands stored in the buffer.

39216-08-A

FIGURE 1-9. SA810/860 GENERAL CONTROL AND DATA TIMING REQUIREMENTS

SECTION II
ELECTRICAL INTERFACE

2.1 INTRODUCTION

The interface of the SA810/860 Diskette Drive can be divided into two categories:

a. Signal
b. Power

The following paragraphs provide the electrical definition for each line. See figure 2-1 for all interface connections.

2.2 SIGNAL INTERFACE

The signal interface consists of two categories:

a. Control
b. Data Transfer

All lines in the signal interface are digital in nature and either provide signals to the drive (input), or provide signals to the host (output), via interface connector P1/J1.

2.2.1 Input Lines

There are twelve signal input lines. Nine are standard and three are user installable options (refer to Section VII).

The input signals are of three types, those intended to be multiplexed in a multiple drive system, those not intended to be multiplexed, and those which will perform the multiplexing.

The input signals which are intended to do the multiplexing are:

a. DRIVE SELECT 1
b. DRIVE SELECT 2
c. DRIVE SELECT 3
d. DRIVE SELECT 4

The input signals to be multiplexed are:

a. SIDE SELECT
b. DIRECTION SELECT
c. STEP
d. WRITE GATE
e. WRITE DATA

The input signals which are not multiplexed are:

a. MOTOR ON (May be optionally multiplexed. Refer to paragraph 7.9.)
b. IN USE
c. EXTERNAL WRITE CURRENT SWITCH

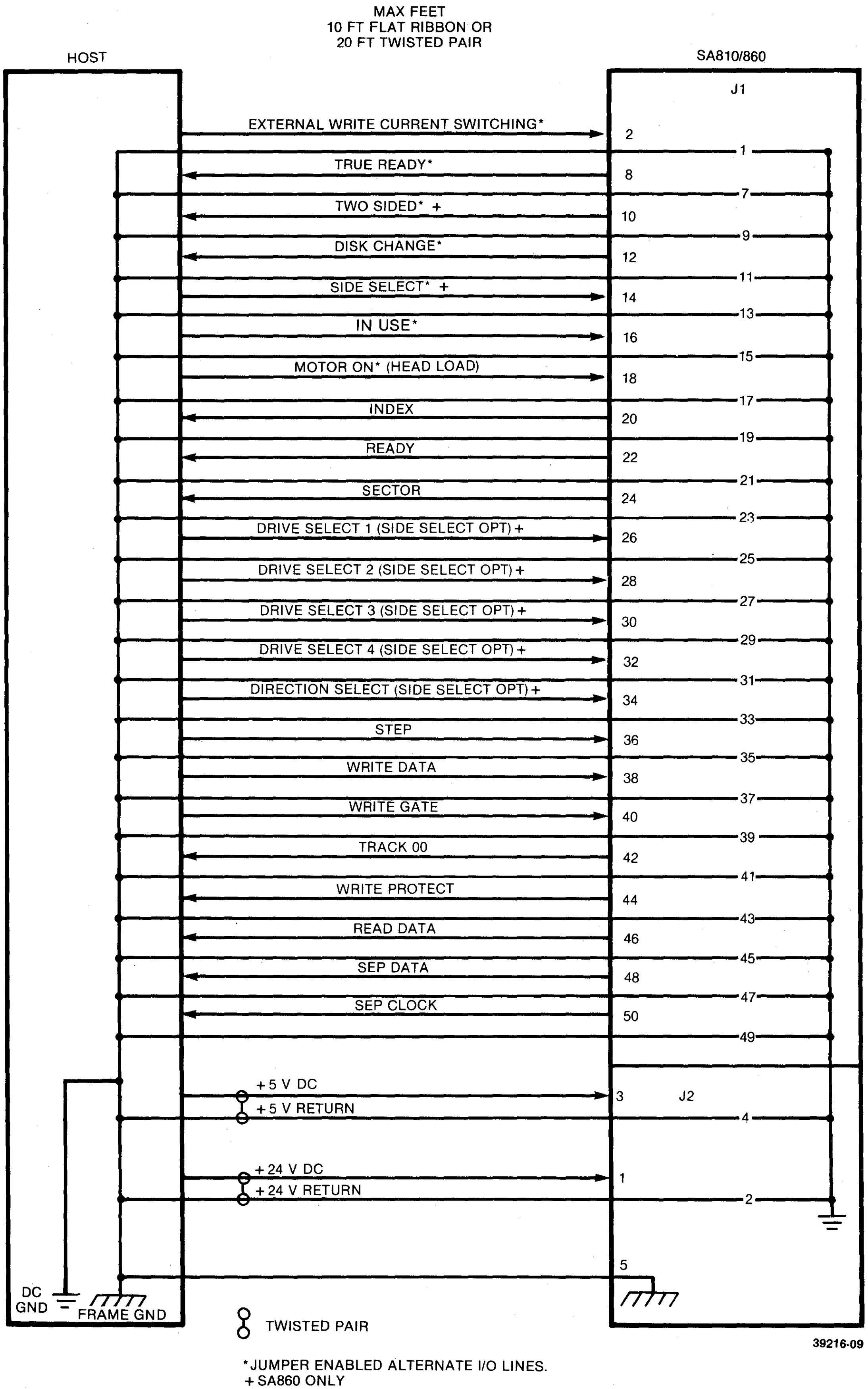


FIGURE 2-1. SA810/860 INTERFACE CONNECTIONS

The input circuit lines have the following electrical specifications. See figure 2-2 for the recommended circuit.

True = Logical zero = Vin ± 0.0 to +0.4 V @ I_{in} = 40 mA (max)

False = Logical one = Vin ± 2.5 to + 5.25 V @ I_{in} = 250 μA (open)

Input Impedance = 220/330 ohms

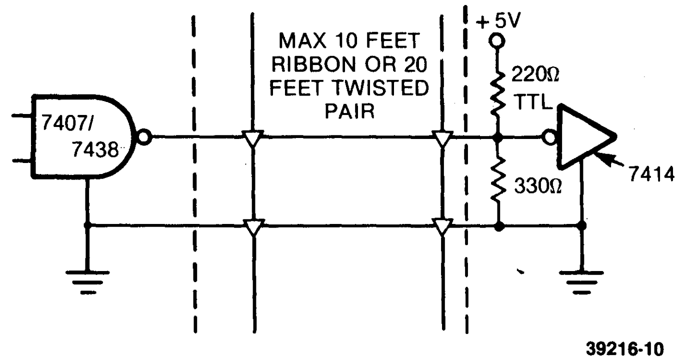


FIGURE 2-2. INTERFACE SIGNAL DRIVER/RECEIVER

2.2.2 Input Line Termination

The SA810/860 has been provided with a removable resistor pack for terminating the eight input lines.

In order for the drive to function properly, the last drive on the interface must have these eight lines terminated. Termination of these lines can be accomplished by either of two methods:

a. As shipped from the factory, the resistor pack is installed in location U9. These packs can be removed from all drives except the last one on the interface.

b. External termination may be used provided the terminator is beyond the last drive. Each of the lines should be terminated by using a 220/330 ohm, ¼ watt resistor, pulled up to +5 V dc.

The same removable resistor pack is also provided for terminating the optional input lines.

2.2.3 Drive Select 1-4

DRIVE SELECT, when activated to a logical zero level, enables the multiplexed I/O lines, starts the spindle motor, energizes the stepper motor, locks the door, and lights the activity LED. In this mode of operation, only the drive with this line active will respond to the input lines and gate the output lines.

Four separate input lines, DRIVE SELECT 1, DRIVE SELECT 2, DRIVE SELECT 3, and DRIVE SELECT 4, are provided so that up to four drives may be multiplexed together in a system and have separate DRIVE SELECT lines. Traces DS1, DS2, DS3, and DS4 have been provided to select which DRIVE SELECT line will activate the interface signals for a unique drive. As shipped from the factory, a shorting plug is installed on DS1. To select another DRIVE SELECT line, this plug should be moved to the appropriate DS pin.

2.2.4 Side Select (SA860 Only)

This interface line defines which side of a two-sided diskette is used for reading or writing. An open circuit, or logical one, selects the read/write head on the side 0 surface of the diskette. A short to ground, or logical zero, selects the read/write head on the side 1 surface of the diskette. When switching from one head to the other, a 100 μs delay is required before any read or write operation can be initiated.

Two optional methods of side selection are available and can be implemented by the user through appropriate jumper connections. These options are described in paragraphs 7.5 and 7.6.

2.2.5 Direction Select

This interface line is a control signal which defines the direction of motion the read/write heads will take when the STEP line is pulsed. An open circuit, or logical one, defines the direction as "out" and if a pulse is applied to the STEP line, the read/write heads will move away from the center of the disk. Conversely, if this input is shorted to ground, or a logical zero level, the direction of motion is defined as "in" and if a pulse is applied to the STEP line, the read/write heads will move towards the center of the disk. If buffered stepping is used, any changes to the DIRECTION SELECT line will be ignored by the drive during the time step pulses(s) are not input.

A jumper-selectable option is available which allows the DIRECTION SELECT line to be time shared for both the DIRECTION SELECT and SIDE SELECT functions. That is, during head positioning operations, the DIRECTION SELECT line controls direction of head motion. During read or write operations, the DIRECTION SELECT line determines which head is selected. Details regarding the implementation of this option are provided in paragraph 7.5.

NOTE

> A 16 ms delay must be introduced when changing direction (i.e., the last step-in pulse to the first step-out pulse or vice versa).

2.2.6 Step

This interface line is a control signal which causes the read/write heads to move with the direction of motion defined by the DIRECTION SELECT line.

The access motion is initiated on each logical one to logical zero transition or the leading edge of the signal pulse. For a standard seek, step pulses may be received at a rate of 3 ms minimum time between pulses having a 1 μs minimum pulse width. Any change in the DIRECTION SELECT line must be made at least 1 μs minimum before the leading edge of the STEP pulse. Refer to figure 1-3 for these timings.

Buffered stepping may be done by issuing pulse(s) to the drive at a rate of 15 μs minimum to 2.9 ms maximum time between pulses having a 1 μs minimum pulse width. Pulses are stored in a buffer which will issue step commands to the drive stepper motor at a 3 ms pulse rate. The first step begins upon receipt of the first step pulse. Any change to the DIRECTION SELECT line during the time step pulse(s) are not input will be discounted by the drive. See figure 1-4 for these timings.

2.2.7 Write Gate

The active state of this signal (logical zero) enables WRITE DATA to be written on the diskette. The inactive state (logical one) enables the read data logic (SEPARATED DATA, SEPARATED CLOCK, and READ DATA) and stepper logic. Refer to figure 1-8 for WRITE INITIATE timing information.

2.2.8 Write Data

This interface line provides the data to be written on the diskette. Each transition from a logical one level to a logical zero level will cause the current through the read/write head to be reversed, thereby writing a data bit. This line is enabled by WRITE GATE being active. See figure 1-8 for timing information.

2.2.9 Motor On (Alternate Input)

This customer installable option, when enabled by jumpering trace MO or MMO and activated to a logical zero level, will activate the dc spindle motor. Refer to paragraphs 7.8 and 7.9 for uses and method of installation.

2.2.10 In Use (Alternate Input)

This customer installable option will turn on the Activity LED and lock the door. Refer to paragraph 7.7 for uses and method of installation.

2.2.11 External Write Current Switch (Alternate Input)

Reference paragraph 7.2.

2.2.12 Output Lines

There are nine standard output lines from the SA810/860 with two optional output lines and two alternate outputs available. The output signals are driven with an open collector output stage capable of sinking a maximum of 40 mA at a logical zero level or true state with a maximum voltage of 0.4 V measured at the driver. When the line driver is in a logical one or false state, the driver is off and the collector current is a maximum of 250 μA. See figure 2-2 for the recommended circuit.

2.2.13 Track 00

The active state of this signal, or a logical zero, indicates when the read/write heads of the drive are positioned at track 00 (the outermost track) and the access circuitry is driving current through phase one of the stepper motor. This signal is at a logical one level, or false state, when the read/write heads of the selected drive are not at track 00.

2.2.14 Index

This interface signal is provided by the drive once each revolution of the diskette (166.67 ms) to indicate the beginning of the track. Normally, this signal is a logical one and makes the transition to the logical zero level for a period of 0.2 to 2.4 ms once each revolution. The timing for this signal is shown in figure 2-3.

To correctly detect INDEX at the control unit, INDEX should be false at DRIVE SELECT time; that is, the controller should see the transition from false to true after the drive has been selected. INDEX pulses will only be provided when the diskette is up to speed.

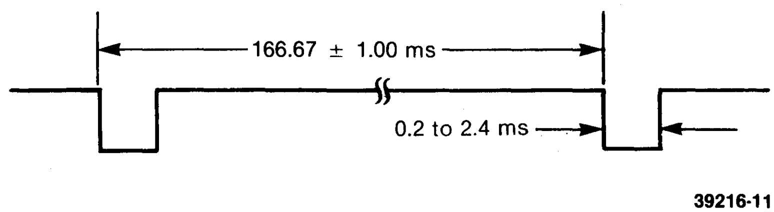


FIGURE 2-3. INDEX TIMING

2.2.15 Sector (Hard Sector Only)

When a hard sectored diskette is inserted and up to speed, this interface signal is provided by the drive 32 times each revolution. Normally, this signal is a logical one and makes the transition to a logical zero for a period of 0.4 ms each time a sector hole on the diskette is detected. Figure 2-4 shows the timing of this signal and its relationship to the INDEX pulse.

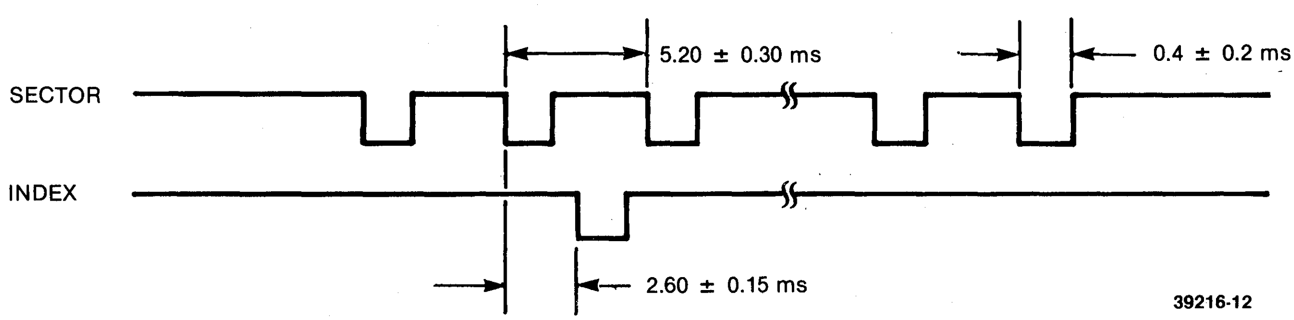


FIGURE 2-4. SECTOR TIMING

2.2.16 Ready

This interface signal indicates that two index holes have been sensed after properly inserting and clamping a diskette. Three holes have to be sensed for two sided diskettes. Whenever the door knob is rotated to the closed position, the spindle motor will be activated by the drive until the READY signal is generated.

If a single sided diskette is installed, READY will be active (logical zero) when SIDE 0 is selected, but false (logical-one) when SIDE 1 is selected. Conversely, if a two-sided diskette is installed, READY will be active when either side of the diskette is selected.

For additional methods of using the READY line, refer to paragraph 7.11.

NOTE

READ DATA, SEP DATA, and SEP CLOCK are only present when DRIVE SELECT and TRUE READY are active (low) and WRITE GATE is inactive (high).

2.2.17 Read Data

This interface line provides the "raw data" (clock and data together) as detected by the drive electronics. Normally, this signal is a logical one level and becomes a logical zero level for the active state. See figure 1-6 for the timing and bit shift tolerance within normal media variations.

2.2.18 Sep Data

This interface line furnishes the data bits as separated from the "raw data" by use of the internal FM data separator. Normally, this signal is a logical one level and becomes a logical zero level for the active state. See figure 1-6 for the timing.

2.2.19 Sep Clock

This interface line furnishes the clock bits as separated from the "raw data" by use of the internal FM data separator. Normally, this signal is a logical one level and becomes a logical zero level for the active state. See figure 1-6 for the timing.

2.2.20 Write Protect

This interface signal is provided by the drive to give the user an indication when a write protected diskette is installed. This signal is a logical zero level when it is protected. Under normal operation, the drive will inhibit writing with a protected diskette installed in addition to notifying the interface.

For other methods of using write protect, refer to paragraph 7.13.

2.2.21 True Ready

This output (pin 8) signals that the drive is ready to handle data. The line will come true (active low) when the diskette is up to speed, all seek functions have been completed, and the READY line is active (refer to paragraph 2.2.16). It is recommended that this signal be used in place of motor start and seek complete timers.

2.2.22 Disk Change (Optional Output)

Reference paragraph 7.4.

2.2.23 Two Sided (Optional Output)

Reference paragraph 7.3.

2.2.24 Alternate I/O Pins

These interface lines (pins 4 and 6) have been provided for use with customer installable options. Refer to Section VII for methods of use.

2.3 POWER INTERFACE

The SA810 and SA860 require only dc power for operation. DC power to the drive is provided via P2/J2 located on the component side of the PCB near the stepper motor. The two dc voltages, their specifications, and their P2/J2 pin designators are outlined in table 2-1. The specifications outlined on current requirements are for one drive. For multiple drive systems, the current requirements are a multiple of the maximum current times the number of drives in the system. See figure 2-5 for the dc power requirements during various operations.

2.4 FRAME GROUNDING

The drive must be frame grounded to the host system to ensure proper operation. If the frame of the drive is not fastened directly to the frame of the host system with a good ac ground, a wire from the system ac frame ground must be connected to the drive. For this purpose, a faston tab is provided on the drive where a faston connector can be attached or soldered. The tab is AMP P/N 61664-1 and its mating connector is AMP P/N 60972-1.

TABLE 2-1. DC POWER REQUIREMENTS

P2 PIN	DC VOLTAGE	TOLERANCE	CURRENT	MAX RIPPLE (p to p)
1	+24 V DC*	±2.4 V DC	1.7 A MAX 1.0 A MAX	100 mV MAX ALLOWABLE
2	+ 24 V RETURN**			
3	+5 V DC	±0.25 V DC	1.0 A MAX 0.7 A TYP	50 mV MAX ALLOWABLE
4	+ 5 V RETURN**			
5	FRAME GROUND			

*If the stepper motor is energized by the controller during the spindle motor start-up time, the drive will exceed the + 24 V DC current specification of 1.7 A max. Under this condition, the current specification is 2.2 A max.

39216-13

**Returns are tied together at the drive PCB.

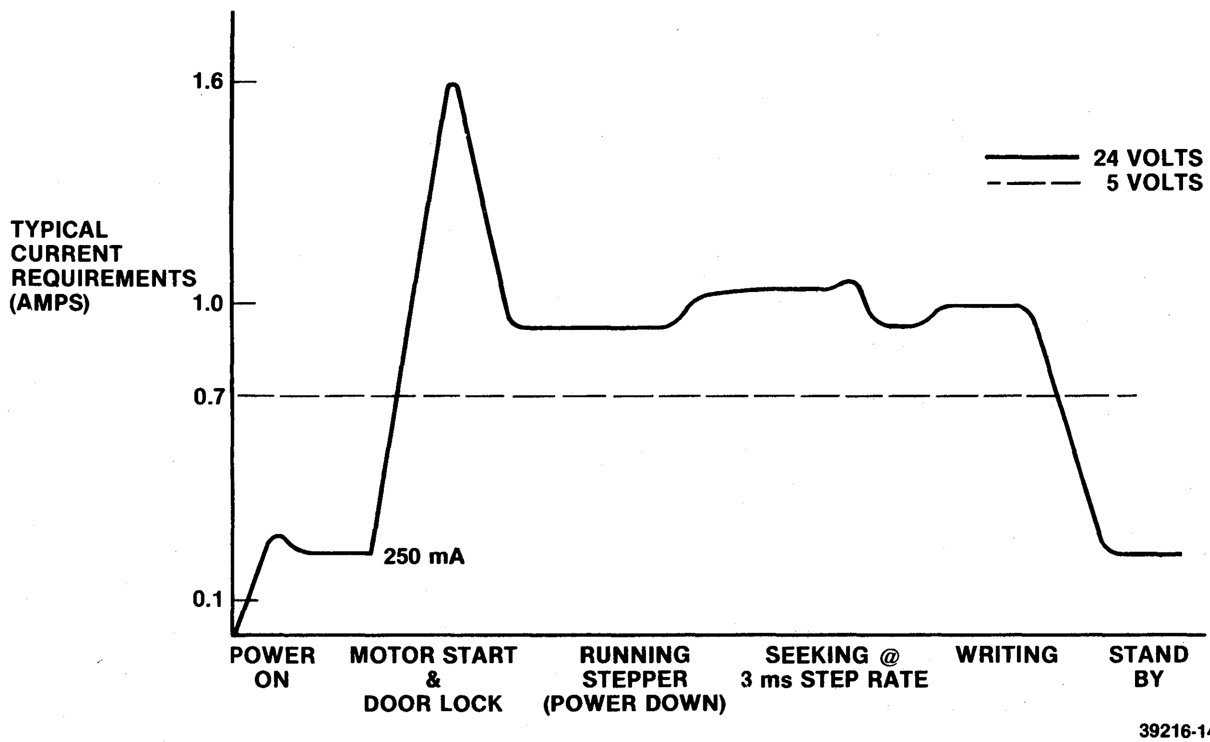


FIGURE 2-5. DC POWER PROFILE

SECTION III
PHYSICAL INTERFACE

3.1 INTRODUCTION

The electrical interface between the SA810 or SA860 and the host system is via two connectors. The first connector, J1, provides the signal interface and the second connector, J2, provides the dc power.

This section describes the physical connectors used on the drive and the recommended connectors to be used with them. Refer to figure 3-1 for connector locations.

3.2 J1/P1 CONNECTOR

Connection to J1 is through a 50 pin PCB edge connector. The dimensions for this connector are shown in figure 3-2. The pins are numbered 1 through 50 with the even numbered pins on the component side of the PCB and the odd numbered pins on the non-component side. Pin 2 is located on the end of the PCB connector closest to the dc connector and is labeled 2. A key slot is provided between pins 4 and 6 for optional connector keying.

The recommended connectors for P1 are shown in table 3-1.

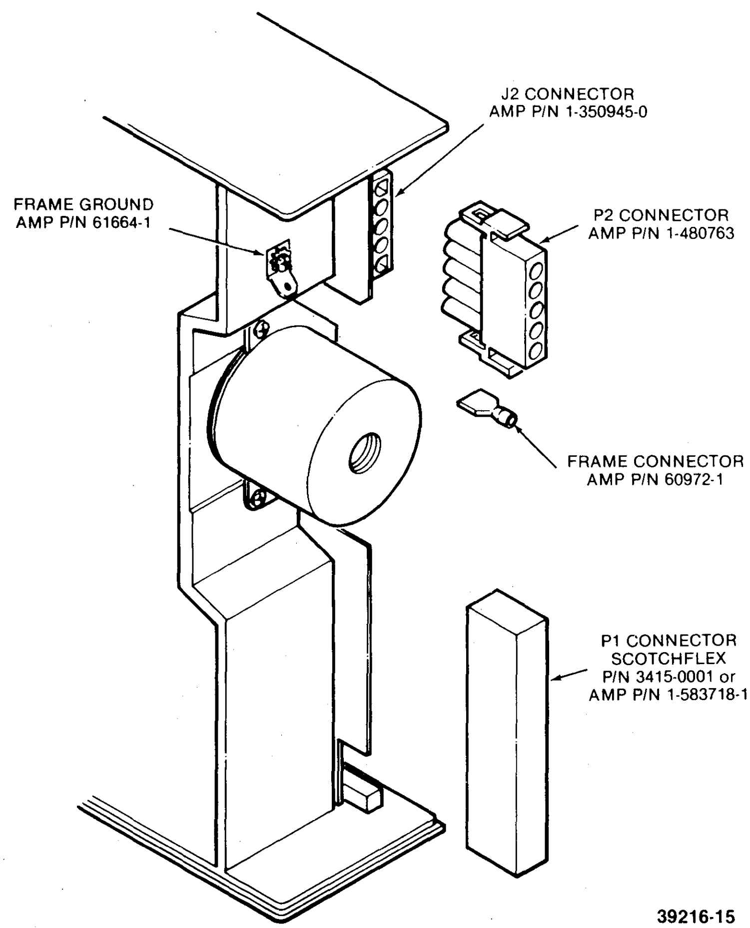


FIGURE 3-1. INTERFACE CONNECTORS - PHYSICAL LOCATIONS

TABLE 3-1. RECOMMENDED J1 CONNECTORS

TYPE OF CABLE	MANUFACTURER	CONNECTOR P/N	CONTACT P/N
TWISTED PAIR, #18 (CRIMP OR SOLDER)	AMP	1-583718-1	583616-5 (CRIMP) 583854-3 (SOLDER)
TWISTED PAIR, #18 (SOLDER TERM.)	VIKING	3VH25/1JN-5	NA
FLAT CABLE	3M "SCOTCHFLEX"	3415-0001	NA

39216-16

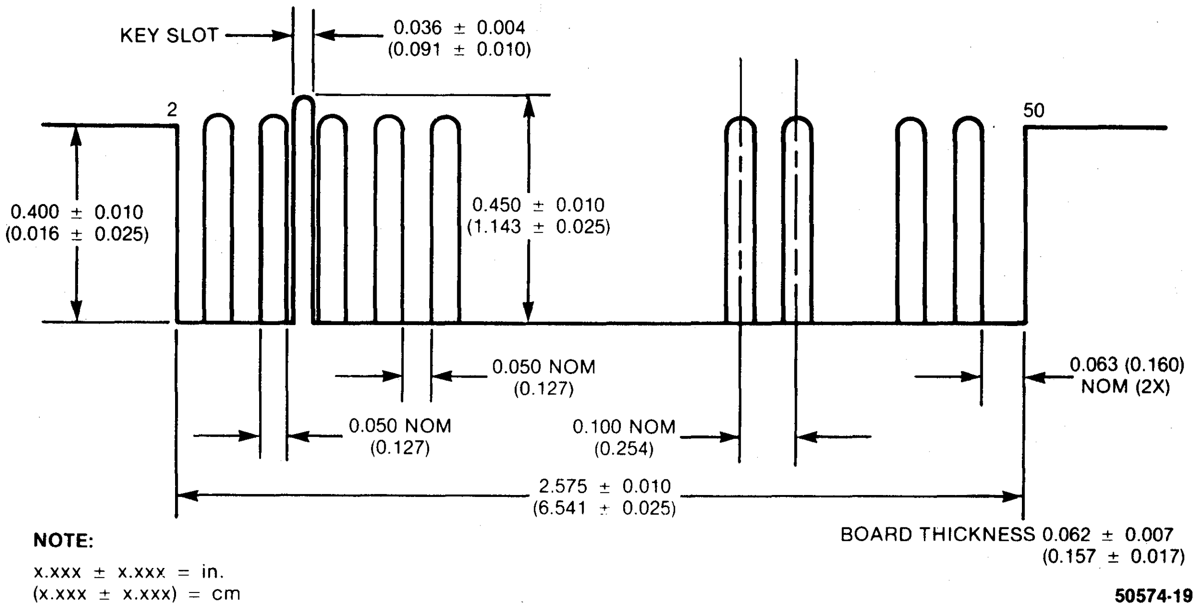


FIGURE 3-2. J1 CONNECTOR DIMENSIONS

3.3 J2/P2 CONNECTOR

The dc power connector, J2, is mounted on the component side of the PCB and is located near the stepper motor. J2 is a 5 pin AMP Mate-N-Lok connector P/N 1-350945-0. The recommended mating connector (P2) is AMP P/N 1-480763 utilizing AMP pins P/N 350689-1. J2, pin 1, is labeled on the component side of the PCB. Figure 3-3 illustrates the J2 connector.

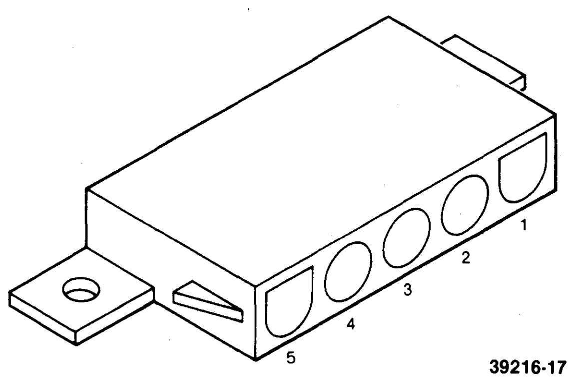


FIGURE 3-3. J2/P2 CONNECTOR

SECTION IV
DRIVE PHYSICAL SPECIFICATIONS

4.1 INTRODUCTION

This section describes the mechanical dimensions and mounting recommendations for the SA810/860.

4.2 MECHANICAL DIMENSIONS

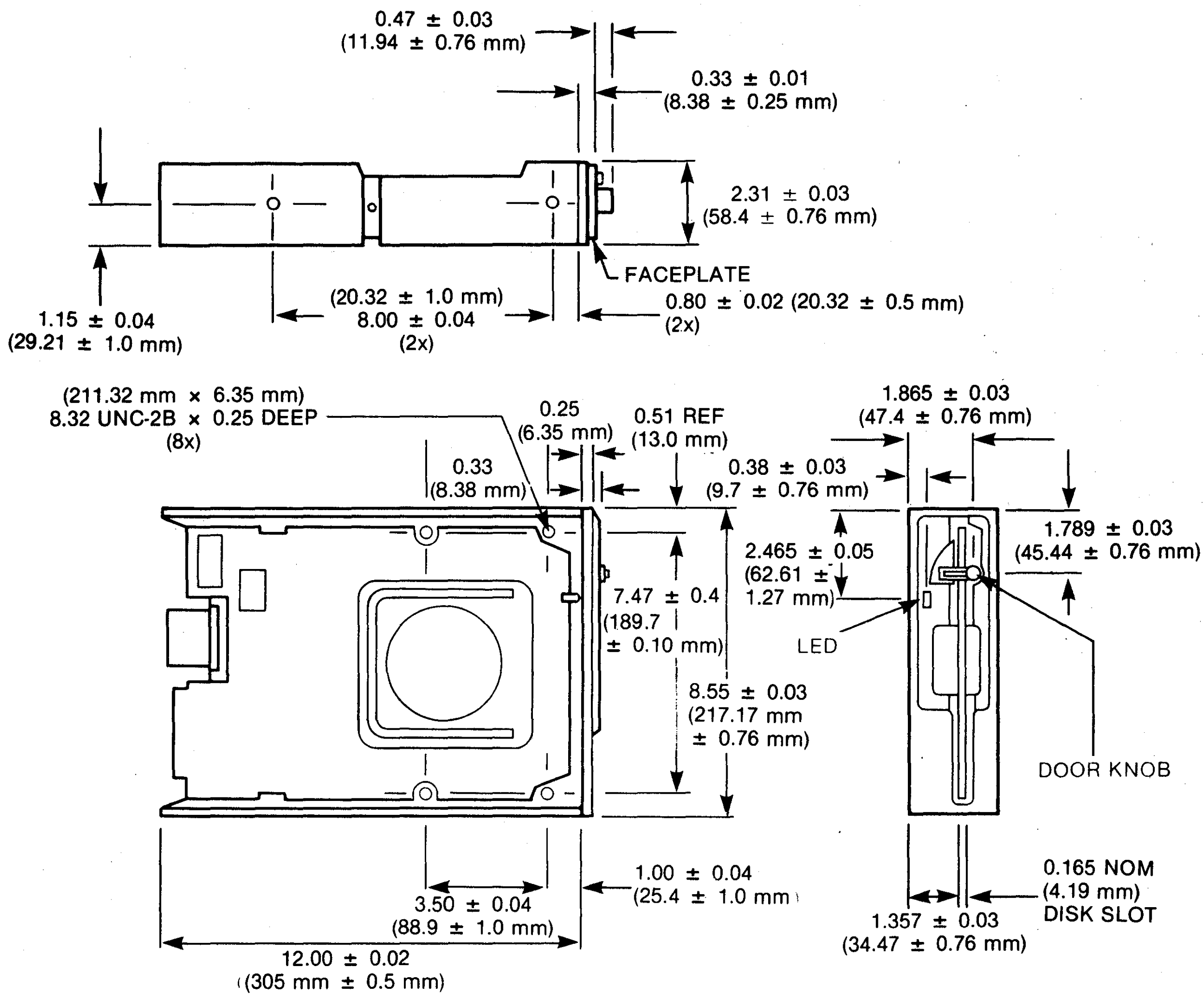
See figure 4-1 for the dimensions of the SA810/860.

4.3 MOUNTING

The SA810/860 is capable of being mounted any position.

4.4 STACKING DUAL DRIVES

When using the bottom mounting holes of the SA810/860, a second unit may be mounted on top of the first using a mounting kit (P/N 51592). This method of mounting is not recommended when high shock or vibration levels are expected.



NOTES

a. Measurements are in inches unless otherwise specified.

b. Faceplate allows 1/8" (3.17 mm) clearance on all four sides for bezels.

FIGURE 4-1. PHYSICAL DIMENSIONS

SECTION V
ERROR RECOVERY

5.1 WRITE ERRORS

If an error occurs during a write operation, it will be detected on the next revolution by doing a read operation, commonly called a write check. To correct the error, another write and write check operation must be done. If the write operation is not successful after 10 attempts, a read operation should be attempted on another track to determine if the media or the drive is failing. If the error still persists, the disk should be considered defective and discarded.

5.2 READ ERRORS

Most errors that occur will be soft errors; that is, by performing an error recovery procedure, the data will be recovered.

Soft errors are usually caused by:

a. Airborne contaminants that pass between the read/write head and the disk. These contaminants will generally be removed by the cartridge self-cleaning wiper.
b. Random electrical noise which usually lasts for a few microseconds.
c. Small defects in the written data and/or track not detected during the write operation which may cause a soft error during a read.

The following procedures are recommended to recover from soft errors:

a. Reread the track 10 times or until such a time as the data is recovered.
b. If data is not recovered after using step (a), access the head to the adjacent track in the same direction previously moved, then return to the desired track.
c. Repeat step (a).
d. If data is not recovered, the error is not recoverable.

5.3 SEEK ERRORS

Seek errors are detected by reading an ID field after the seek is completed. The ID field contains the track address. If a seek error is detected, the host system should issue a recalibrate operation (step out until Track 00 line goes active) and seek back to the original track.

SECTION VI
RECORDING FORMAT

6.1 RECORDING FORMAT (SINGLE DENSITY)

The format of the data recorded on the diskette is totally a function of the host controller. Data is recorded on the diskette using frequency modulation as the recording mode, i.e., each data bit recorded on the diskette has an associated clock bit recorded with it. This is referred to as FM encoding. Data written on and read back from the diskettes takes the form shown in figure 6-1. The binary data pattern shown in figure 6-2 represents a "101."

6.1.1 Bit Cell

As shown in figure 6-2, the clock bits and data bits (if present) are interleaved. By definition, a bit cell is the period between the leading edge of one clock bit and the leading edge of the next clock bit.

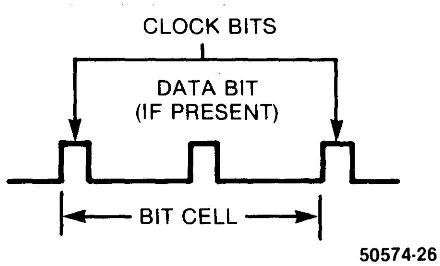


FIGURE 6-1. DATA PATTERN

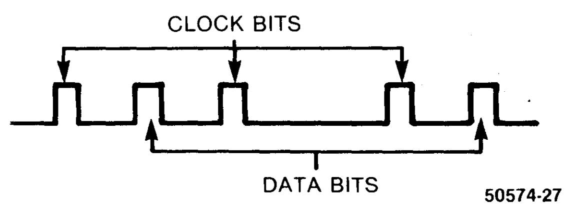


FIGURE 6-2. BIT CELL

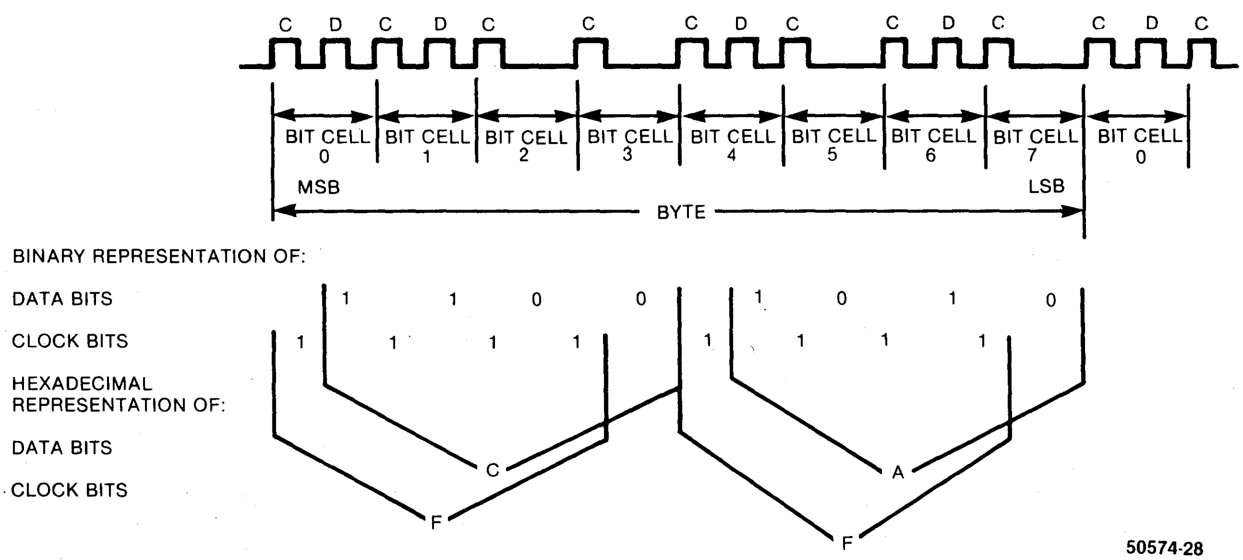


FIGURE 6-3. BYTE

6.1.2 Byte

A byte, when referring to serial data (being written onto or read from the disk drive), is defined as eight consecutive bit cells. The most significant bit cell is defined as bit cell 0 and the least significant bit cell is defined as bit cell 7. When reference is made to a specific data bit (i.e., data bit 3), it is with respect to the corresponding bit cell (bit cell 3).

During a write operation, bit cell 0 of each byte is transferred to the disk drive first with bit cell 7 being transferred last. Correspondingly, the most significant byte of data is transferred to the disk first and the least significant byte is transferred last.

When data is being read back from the drive, bit cell 0 of each byte will be transferred first with bit cell 7 last. As with writing, the most significant byte will be transferred first from the drive to the user.

Figure 6-3 illustrates the relationship of the bits within a byte. Figure 6-4 illustrates the relationship of the bytes for read and write data.

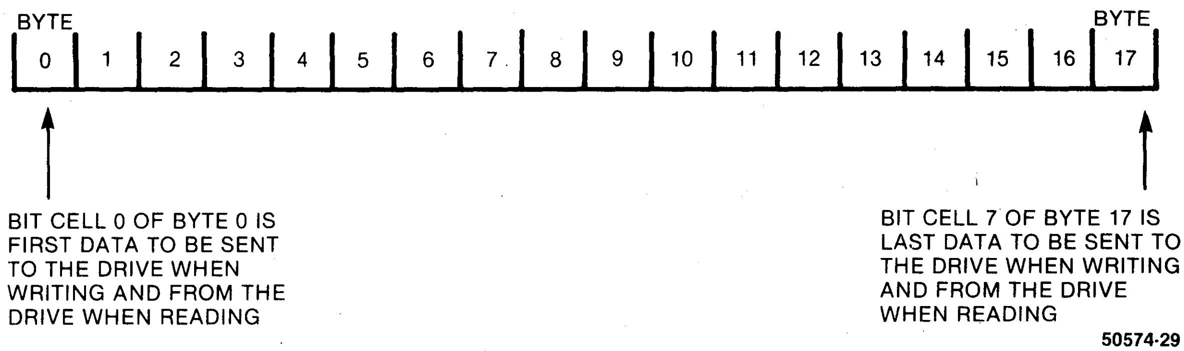


FIGURE 6-4. DATA BYTES

6.2 RECORDING FORMAT (DOUBLE DENSITY)

Double capacity can be obtained by use of MFM (modified frequency modulation) rather than FM (frequency modulation) which is the standard method of encoding data on the diskette.

The differences between FM and MFM encoding are shown in figure 6-5. Note that MFM results in a 1 to 1 relationship between the flux changes per inch and the data bits per inch recorded on the diskette. This also results in a doubling of the data transfer rate, from 250 to 500 k bytes, when compared to FM.

Data error rate performance equal to standard capacity diskettes using FM encoding can be achieved by using:

a. The SA810/860 diskette drive with its proprietary ceramic/ferrite read/write head.
b. Phase locked loop (VFO) data separator.
c. Write precompensation.

Provision of the phase locked loop data separator and write precompensation circuitry is the responsibility of the user of the SA810/860 diskette drive.

Shugart will provide design information, as required, to SA810/860 users who desire to incorporate double capacity diskette drives in their products.

The bit cell for MFM encoded data is one half the duration of the bit cell for FM encoded data. Also, unlike FM, MFM bit cells do not always contain a clock bit at the leading edge. This lack of a clock bit makes data separation more complex. Also, the window size is half the FM window size, which results in less tolerance to bit shift. The only reliable method to separate MFM encoded data is through use of a phase locked loop (VFO) type of data separator. The VFO, once synchronized, tracks the data and generates clock and data windows. This improves the bit shift tolerance over the conventional "hard" data separators commonly used in FM recording which use windows of fixed timing.

6.3 RULES OF ENCODING

6.3.1 FM Encoding:

a. Writes data bits at the center of the bit cell.
b. Writes clock bits at the leading edge of the bit cell.

6.3.2 MFM Encoding:

a. Writes data bits at the center of the bit cell.
b. Writes clock bits at the leading edge of the bit cell if:
   - There is no data bit written in the previous bit cell, and
   - There will be no data bit written in the present bit cell.

NOTE

In MFM, the write oscillator frequency is doubled while maintaining the same flux changes per inch as FM. Thus, the bit cell in MFM is half that in FM. Data transfer rate is also doubled, since a 1 to 1 relationship exists between flux changes per inch and data bits per inch (2 to 1 in FM).

Index is the physical detector indicating one revolution of the media. It is used to initiate format operations, generate the READY signal in the storage device, and ensure that one complete revolution of the media has been searched. It is also used for a deselect storage device signal after a certain number of revolutions. Some of the more common format fields are explained in the following paragraphs.

6.4 TRACKS AND RECORDING FORMATS

6.4.1 Tracks

The SA810/860 drive is capable of recording up to 77/154 tracks of data. The tracks are numbered 0-76 for each side. Each track is made available to the read/write heads by accessing the head with a stepper motor and carriage assembly, and selecting the desired side of the diskette.

Basic Track Characteristics:

No. Data Bits/Track Single Density	41,664 bits (5208 bytes)
No. Data Bits/Track Double Density	83,328 bits (10,416 bytes)
Index Pulse Width	1.8 ± 0.6 ms
Index/Sector Pulse Width (Hard Sectored Only)	0.4 ± 0.2 ms

6.4.2 Track Format

Tracks may be formatted in numerous ways and are dependent on the using system. The SA810/860 use index and sector recording formats respectively.

6.4.3 Hard Sector Recording Format

In this format, the using system may record up to 32 sectors (records) per track. Each track is started by a physical index pulse and each sector is started by a physical sector pulse. This type of recording is called hard sectoring. Figure 6-6 shows a typical hard sector recording format for 1 of 32 sectors.

6.4.4 Soft Sector Recording Format

In this format, the using system may record one long record or several smaller records. Each track is started by a physical index pulse and then each record is preceded by a unique recorded identifier. This type of recording is called soft sectoring.

6.4.5 Typical Track Index Format

Figure 6-7 shows a track format, which is IBM compatible, using index recording format with soft sectoring.

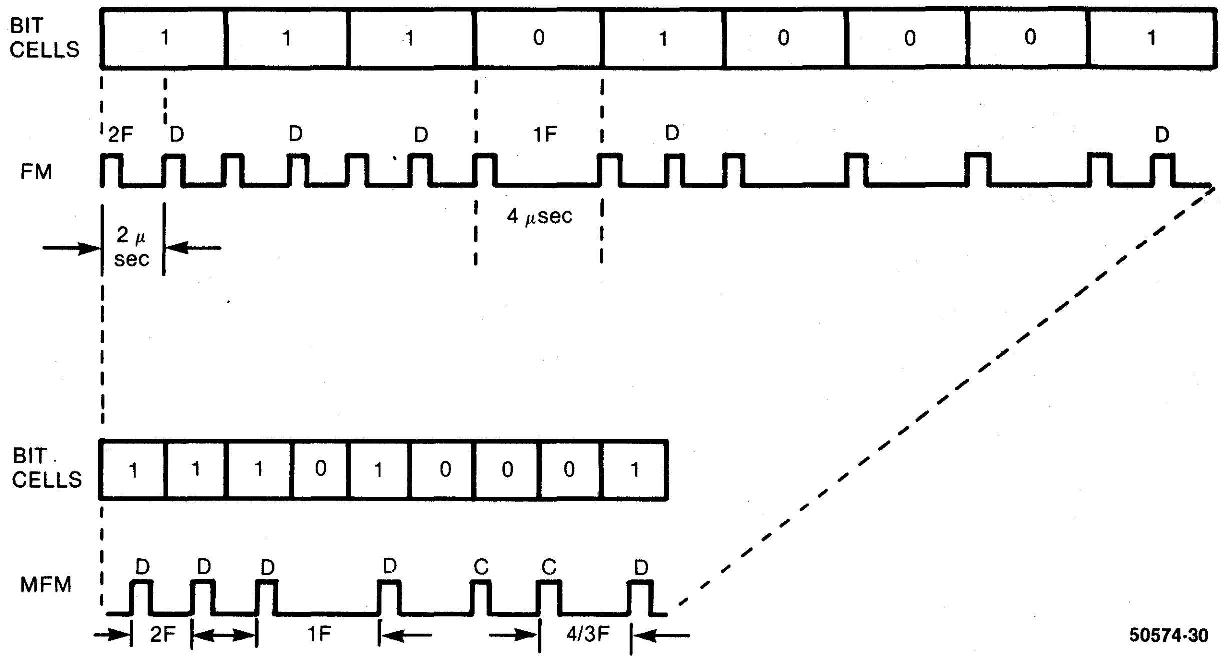


FIGURE 6-5. FM AND MFM ENCODING

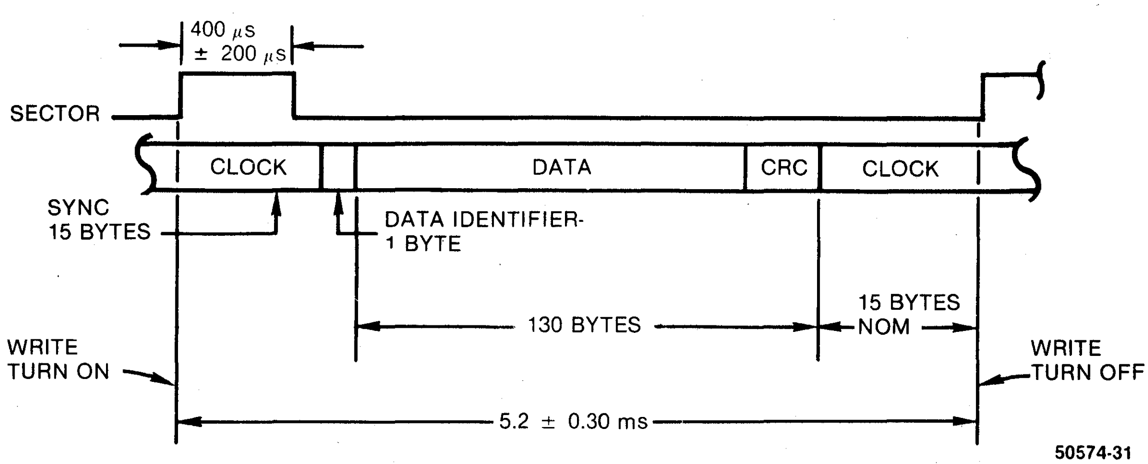
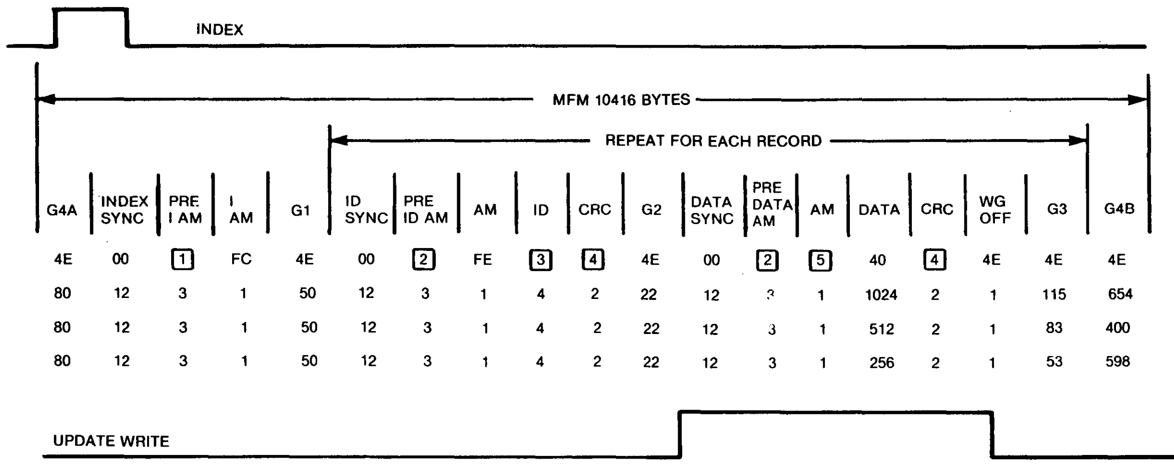


FIGURE 6-6. SA810/860 HARD SECTOR RECORDING FORMAT (FM)



G4A	INDEX SYNC	PRE I AM	I AM	G1	ID SYNC	PRE ID AM	AM	ID	CRC	G2	DATA SYNC	PRE DATA AM	AM	DATA	CRC	WG OFF	G3	G4B	
4E	00	[1]	FC	4E	00	[2]	FE	[3]	[4]	4E	00	[2]	[5]	40	[4]	4E	4E	4E	DATA
80	12	3	1	50	12	3	1	4	2	22	12	3	1	1024	2	1	115	654	BYTES/8 REC.
80	12	3	1	50	12	3	1	4	2	22	12	3	1	512	2	1	83	400	BYTES/15 REC.
80	12	3	1	50	12	3	1	4	2	22	12	3	1	256	2	1	53	598	BYTES/26 REC.

[1] 3 BYTES C2 WITH UNIQUE CLOCK PATTERN 14

[2] 3 BYTES A1 WITH UNIQUE CLOCK PATTERN 0A

[3] TRACK NUMBER, HEAD NUMBER, SECTOR, RECORD LENGTH

[4] GENERATED BY CRC GENERATOR WHICH SHOULD BE EQUIVALENT TO CCITT VH1

[5] 1 BYTE OF FB OR F8

50574-32

FIGURE 6-7. MFM TRACK FORMAT COMPARISON

Gap 1- **G4A** is from the physical index address mark sync and allows for physical index variation, speed variation, and interchange between storage devices.

Sync is a fixed number of bytes for separator synchronization prior to the address mark. It includes a minimum of two bytes plus worst case separator sync up requirements.

Index Pre Address Mark (MFM) is three bytes of C2 with unique clock bits not written per the encode rules. See figure 6-8.

Index Address Mark (FM) is a unique byte to identify the index field and is not written per the encode rules. See figure 6-9.

Index Address Mark (MFM) is one byte of FC and is written per the encode rules. See figure 6-10.

G1 is from index address mark to ID field address mark sync.

ID Field - **Sync** is a fixed number of bytes for separator synchronization prior to the address mark. It includes a minimum of two bytes plus worst case separator sync up requirements.

ID Pre Address Mark (MFM) is three bytes of A1 with unique clock bits not written per the encode rules. See figure 6-8.

ID Address Mark (FM) is a unique byte to identify the ID field and is not written per the encode rules. See figure 6-11.

ID Address Mark (MFM) is one byte of FE and it is written per the encode rules. See figure 6-12.

ID is a four byte address containing track number, head number, record number, and record length.

CRC is two bytes for cyclic redundancy check.

Gap 2 - **Gap 2** is from IDCRC to data address mark sync and allows for speed variation, oscillator variation, and erase core clearance of IDCRC bytes prior to write gate turn on for an update write.

Data Field - **Sync** is a fixed number of bytes for separator synchronization prior to the address mark. Includes a minimum of two bytes plus worst case separator sync up requirements.

Pre Data Address Mark (MFM) is three bytes of A1 with unique clock bits not written per the encode rules. See figure 6-13.

Data Address Mark (FM) is a unique byte to identify the Data Field and is not written per the encode rules. See figures 6-14 and 6-15.

Data Address Mark (MFM) is one byte of FB or F8 and it is written per the encode rules. See figure 6-16 and 6-17.

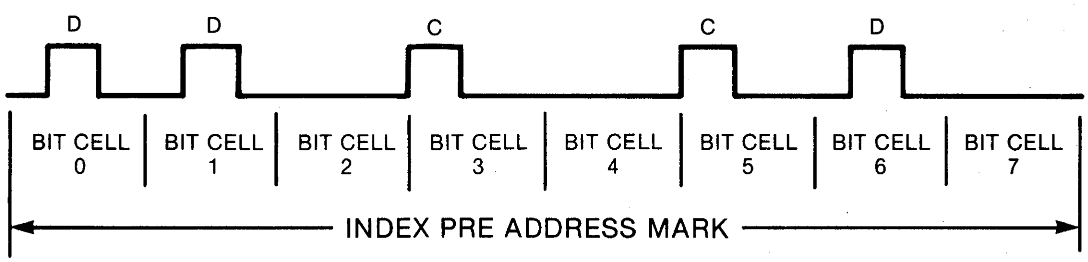
Data is the area for user data.

CRC is two bytes for cyclic redundancy check.

WG OFF (Write Gate Off) is one byte to allow for the WRITE GATE turn off after an update write.

Gap 3 - **Gap 3** is from WG OFF to the next ID AM sync and allows for the erase core to clear the Data Field CRC bytes, speed and write oscillator variation, read preamplifier recovery time, and system turn around time to read the following ID Field.

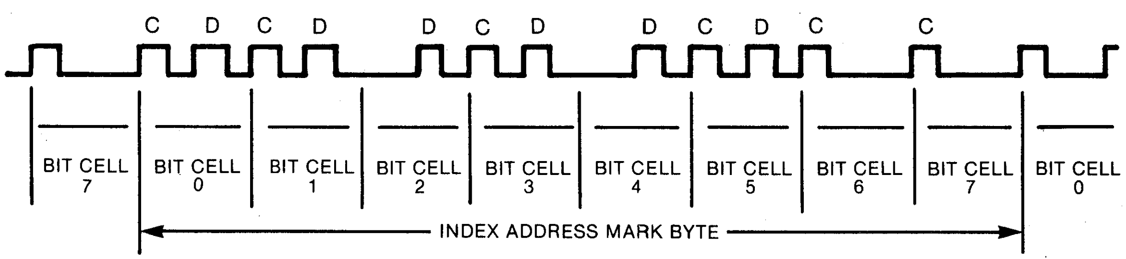
Gap 4 - **G4B** is the last gap prior to physical index and allows for speed and write oscillator variation during a format write and physical index variation.



BINARY REPRESENTATION OF:									HEXADECIMAL REPRESENTATION OF:
DATA BITS	1	1	0	0	0	0	1	0	C2
CLOCK BITS	0	0	0	1	0	1	0	0	14

50574-33

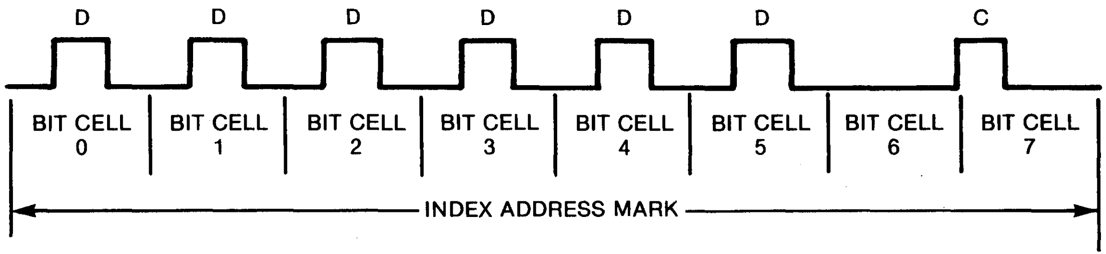
FIGURE 6-8. MFM INDEX PRE ADDRESS MARK



BINARY REPRESENTATION OF:									HEXADECIMAL REPRESENTATION OF:
DATA BITS	1	1	1	1	1	1	0	0	FC
CLOCK BITS	1	1	0	1	0	1	1	1	D7

50574-34

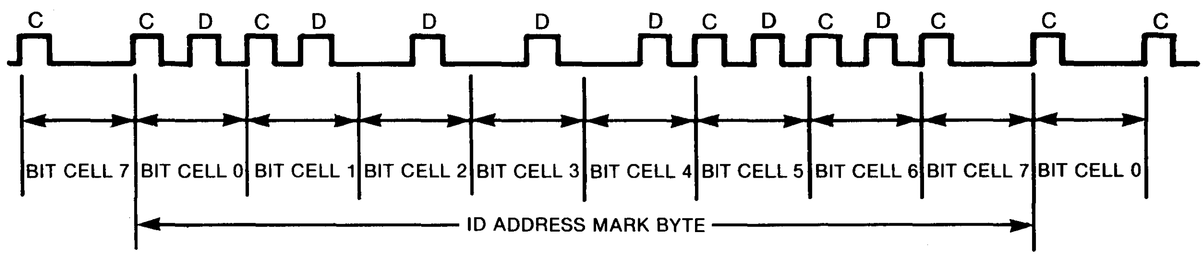
FIGURE 6-9. INDEX ADDRESS MARK FM



BINARY REPRESENTATION OF:									HEXIDECIMAL REPRESENTATION OF:
DATA BITS	1	1	1	1	1	1	1	0	FC
CLOCK BITS	0	0	0	0	0	0	0	1	01

50574-35

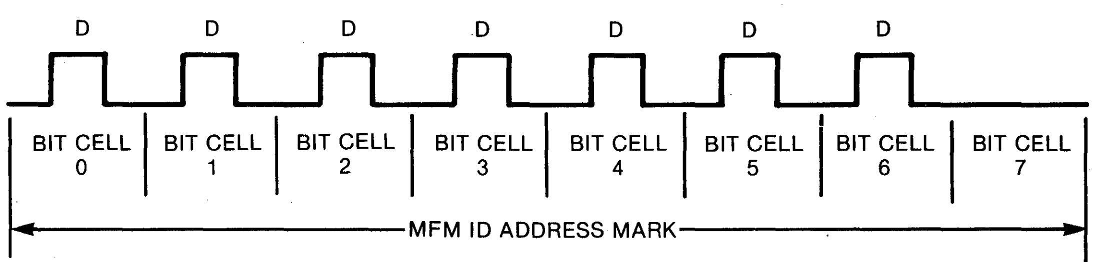
FIGURE 6-10. MFM INDEX ADDRESS MARK



BINARY REPRESENTATION OF:									HEXADECIMAL REPRESENTATION OF:
DATA BITS	1	1	1	1	1	1	1	0	FE
CLOCK BITS	1	1	0	0	0	1	1	1	C7

50574-36

FIGURE 6-11. ID ADDRESS MARK FM



BINARY REPRESENTATION OF:									HEXADECIMAL REPRESENTATION OF:
DATA BITS	1	1	1	1	1	1	1	0	FE
CLOCK BITS	0	0	0	0	0	0	0	0	00

50574-37

FIGURE 6-12. MFM ID ADDRESS MARK

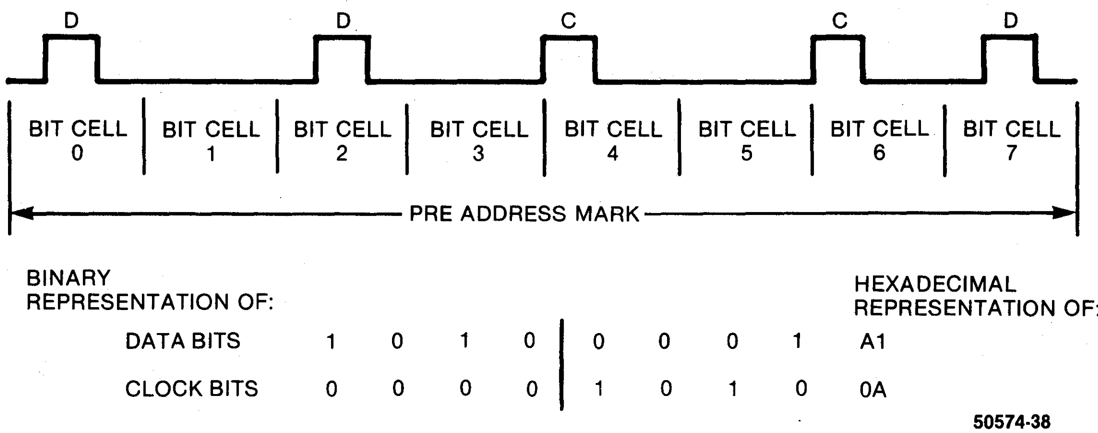


FIGURE 6-13. MFM PRE ID/DATA ADDRESS MARK

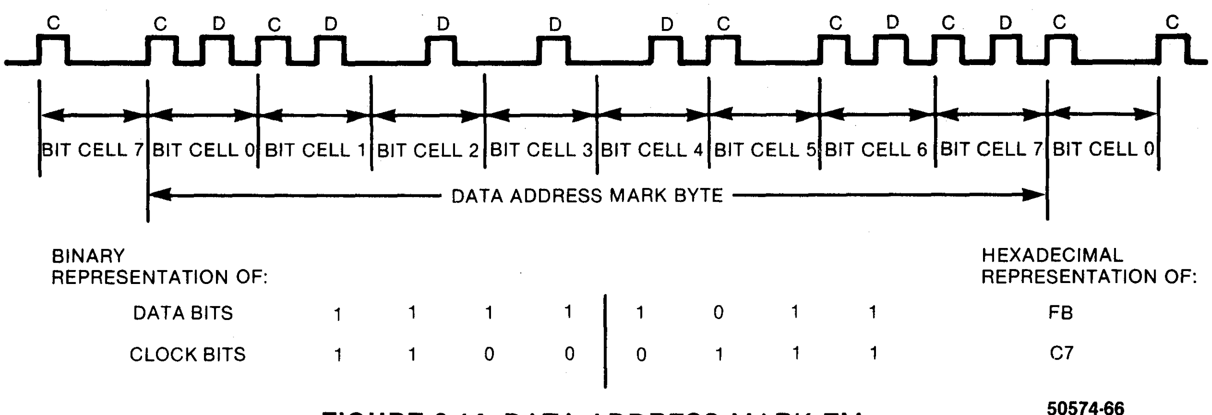


FIGURE 6-14. DATA ADDRESS MARK FM

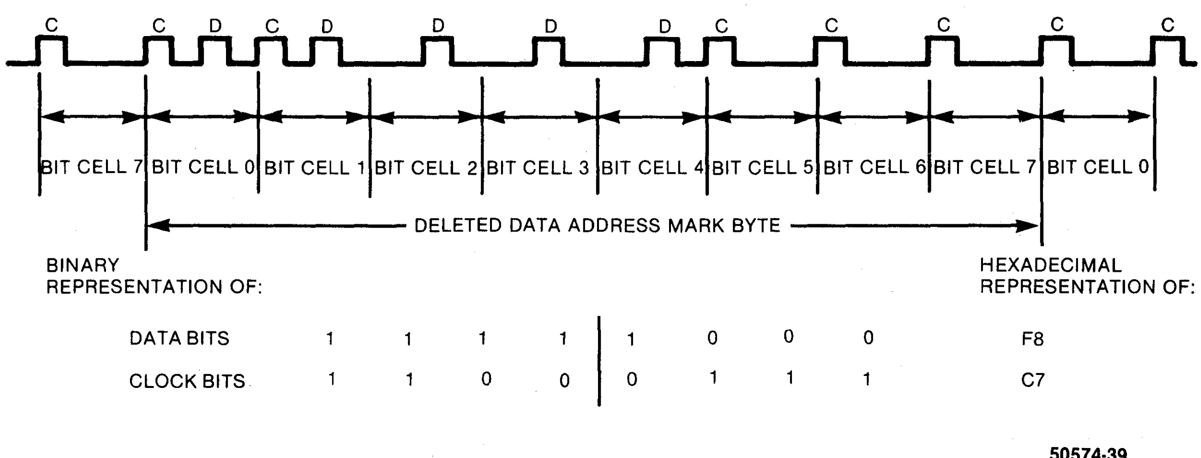
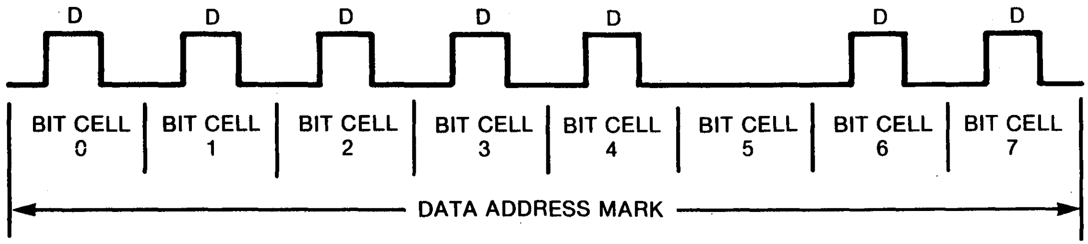


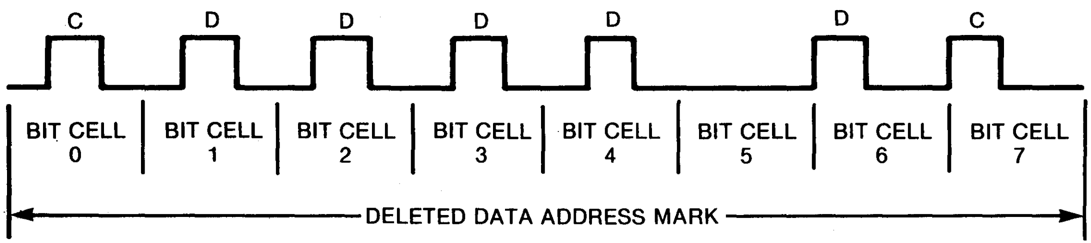
FIGURE 6-15. DELETED DATA ADDRESS MARK FM



BINARY REPRESENTATION OF:									HEXADECIMAL REPRESENTATION OF:
DATA BITS	1	1	1	1	1	0	1	1	FB
CLOCK BITS	0	0	0	0	0	0	0	0	00

50574-67

FIGURE 6-16. MFM DATA ADDRESS MARK



BINARY REPRESENTATION OF:									HEXADECIMAL REPRESENTATION OF:
DATA BITS	1	1	1	1	1	0	0	0	F8
CLOCK BITS	0	0	0	0	0	0	1	1	03

50574-40

FIGURE 6-17. MFM DELETED DATA ADDRESS MARK

SECTION VII
CUSTOMER INSTALLABLE OPTIONS

7.1 INTRODUCTION

The SA810/860 can be modified by the user to function differently than the standard method outlined in Sections I and II. These modifications can be implemented by adding or deleting connections and by use of the alternate I/O pins. Some options are capable of being connected by use of a shorting plug, Shugart P/N 15648 or AMP P/N 53013-2. This section will discuss a few examples of modifications and how to install them. The modifications discussed in the following paragraphs are:

a. External Write Current Switch
b. Two-Sided Status Output (SA860 only)
c. Disk Change Option
d. Side Select Option Using Direction Select (SA860 only)
e. Side Select Option Using Drive Select (SA860 only)
f. In Use Alternate Input
g. Motor On Without Selecting Drive
h. Motor On by Optional Motor On and Drive Select
i. Motor Off Delay
j. Radial Ready
k. Stepper Power Down
l. Write Protect Optional Use

Table 7-1 summarizes these options and the component designators indicating their PCB location in figure 7-1 and 7-2.

TABLE 7-1. CUSTOMER CUT/ADD TRACE OPTIONS

TRACE DESIGNATOR	DESCRIPTION	SHIPPED FROM FACTORY	
		OPEN	SHORT
U9	TERMINATIONS FOR MULTIPLEXED INPUTS		PLUGGED
SI	INTERNAL WRITE CURRENT SWITCH		PLUGGED
SE	EXTERNAL WRITE CURRENT SWITCH	X	
TR	TRUE READY OUTPUT		PLUGGED
RTR	RADIAL TRUE READY†		X
2S	TWO-SIDED STATUS OUTPUT***	X	
DC	DISK CHANGE OPTION	X	
S1	SIDE SELECT OPTION USING DIRECTION SELECT***	X	
S2	SIDE SELECT INPUT***		PLUGGED
S3	SIDE SELECT OPTION USING DRIVE SELECT***	X	
1B,2B,3B,4B	SIDE SELECT OPTION USING DRIVE SELECT***	X	
D	ALTERNATE INPUT-IN USE	X	
MS	MOTOR ON FROM DRIVE SELECT*		PLUGGED
MO	ALTERNATE INPUT-MOTOR ON*	X	
MMO	ALTERNATE INPUT-MULTIPLEXED MOTOR ON*†	X	
MD	MOTOR OFF DELAY	X	
R	READY OUTPUT		X
RR	RADIAL READY		X
SR	STANDARD READY†		PLUGGED
MT	MODIFIED TRUE READY† (OUTPUTS TRUE READY ON PIN 22)	X	
DS1	DRIVE SELECT 1 INPUT		PLUGGED
DS2,3,4	DRIVE SELECT 2,3,4 INPUT	X	
Y	DOOR LOCK/ACTIVITY LIGHT ACTIVATED FROM MOTOR ON†		PLUGGED
Z	DOOR LOCK/ACTIVITY LIGHT ACTIVATED FROM DRIVE SELECT†	X	
PD	STEPPER POWER DOWN	X	
WP	INHIBIT WRITE WHEN WRITE PROTECTED		X
NP	ALLOW WRITE WHEN WRITE PROTECTED	X	
TS	DATA SEPARATION OPTION SELECT**	X	

*MOTOR ON is the complement of HEAD LOAD on the SA801 and SA851 disk drives. The only difference in the operation of MOTOR ON compared with HEAD LOAD is that MOTOR ON requires a 165 ms minimum delay (or TRUE READY must be monitored) before R/W activity is begun. HEAD LOAD on the SA801 and SA851 requires 35 ms or 50 ms minimum delay.

**The SA810/860 offers an optional data separator which properly separates data and clock bits through the soft-sectored IBM standard format and address mark area. Trace "TS" offers the optional separator.

***Applies to SA860 only.

†Available on PCB P/N 25249 only.

39216-19-A

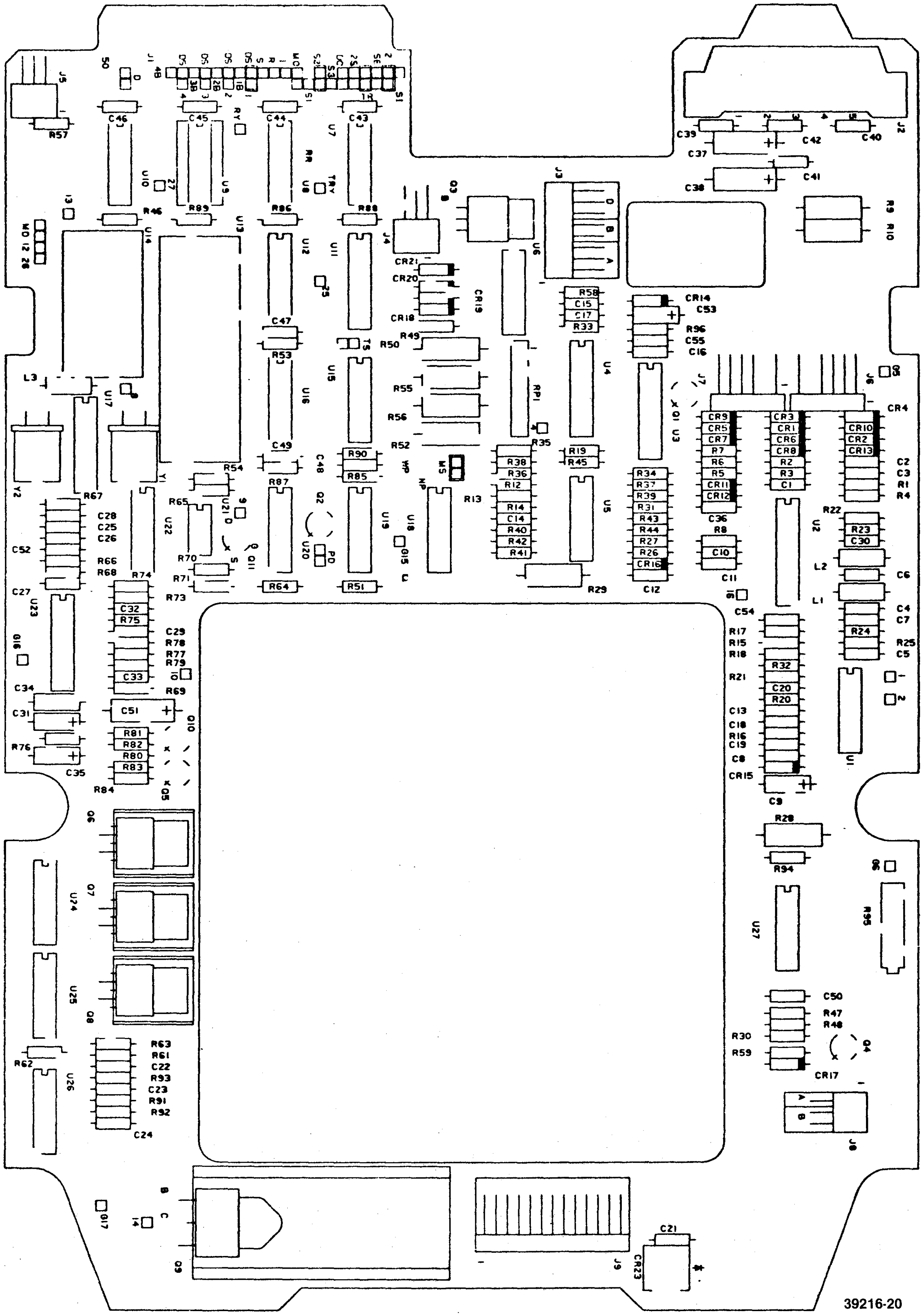


FIGURE 7-1. PCB COMPONENT LOCATIONS (P/N 25227 AND 25247)

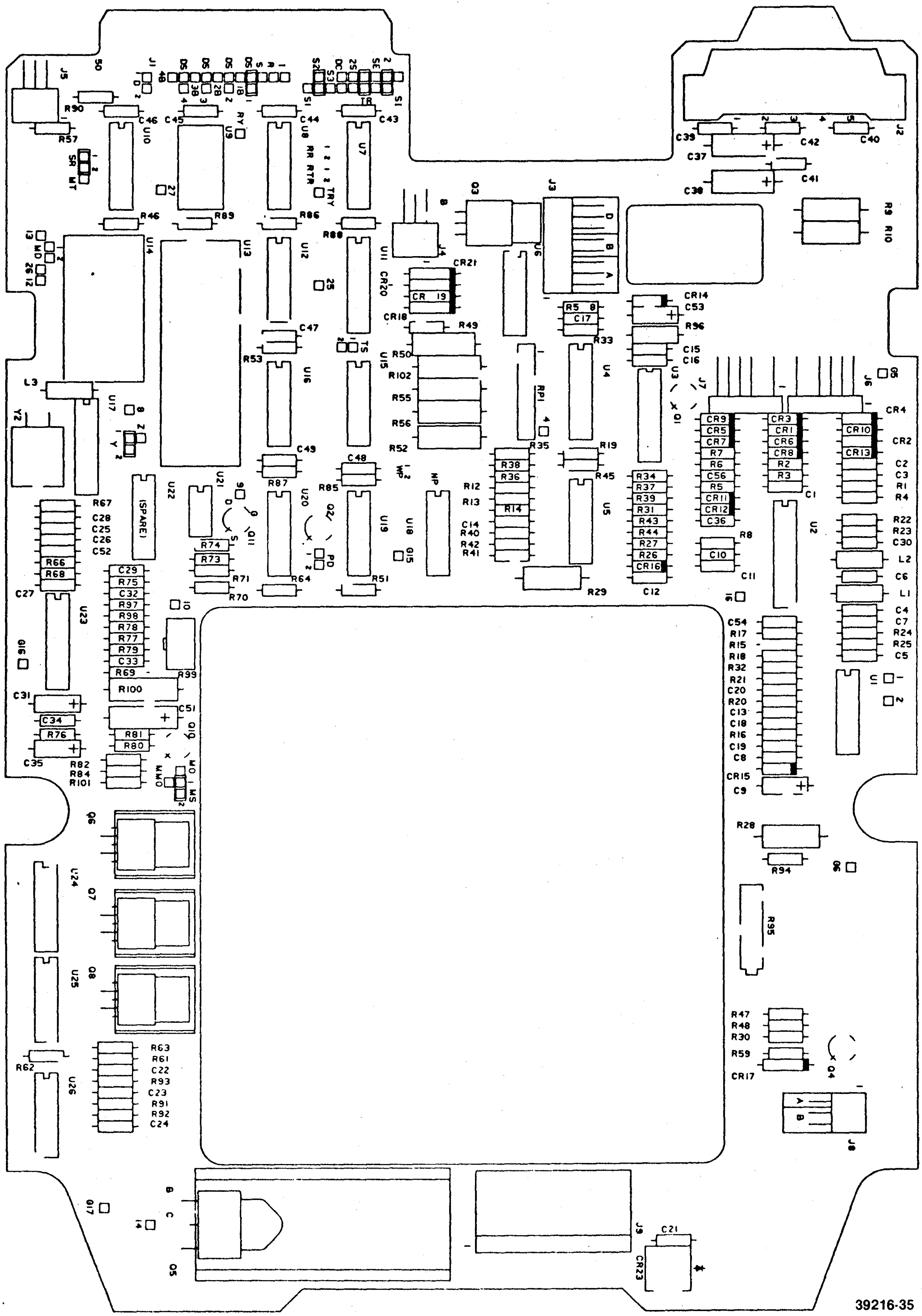


FIGURE 7-2. PCB COMPONENT LOCATIONS (P/N 25249)

7.2 EXTERNAL WRITE CURRENT SWITCH

This option permits write current switching via the optional WRITE CURRENT SWITCHING interface line (pin 2). When the interface signal is activated to a logical zero level, the lower value of the write current is selected. Selecting this option replaces internal write current switching at track 40.

To enable external write current switching, move the shorting plug at trace SI to the SE position. See figure 7-3.

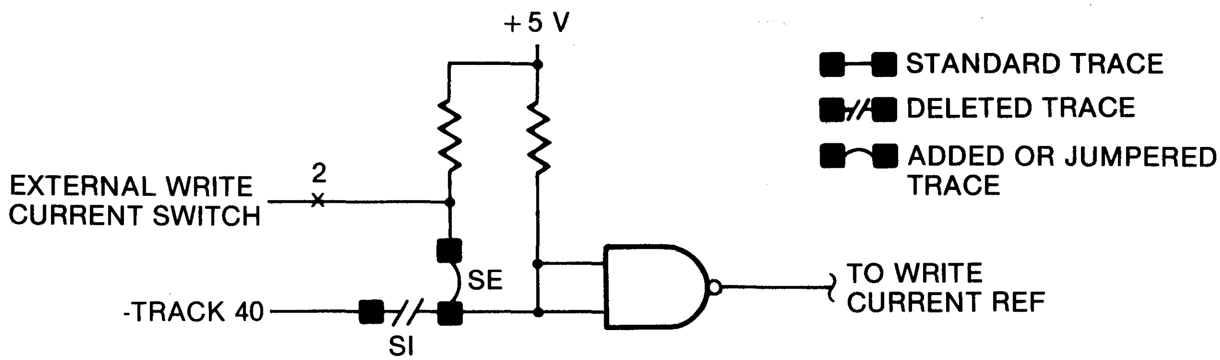


FIGURE 7-3. EXTERNAL WRITE CURRENT OPTION

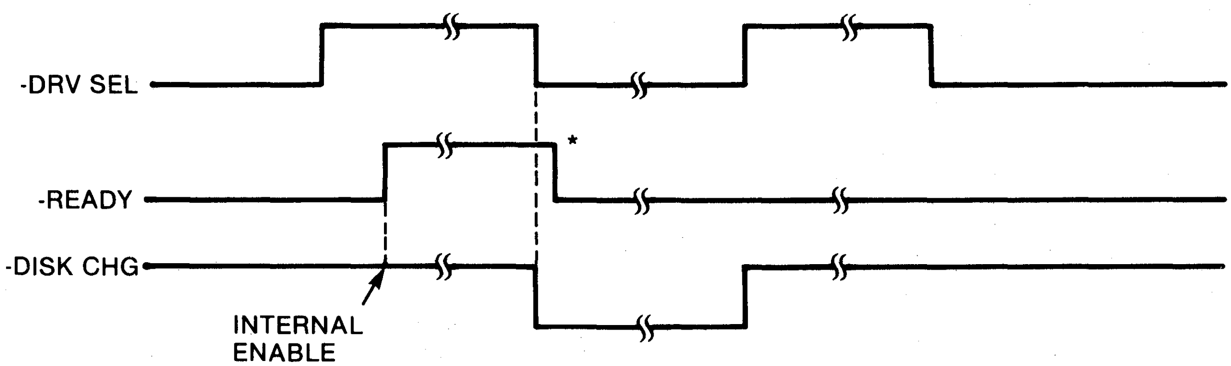
7.3 TWO-SIDED STATUS (OPTIONAL OUTPUT SA860 ONLY)

When the drive is selected and the diskette is spinning, this line will indicate a logical zero level for two sided media, and a logical one for single sided media.

To install this option on a standard drive, jumper trace 2S.

7.4 DISK CHANGE (OPTIONAL OUTPUT)

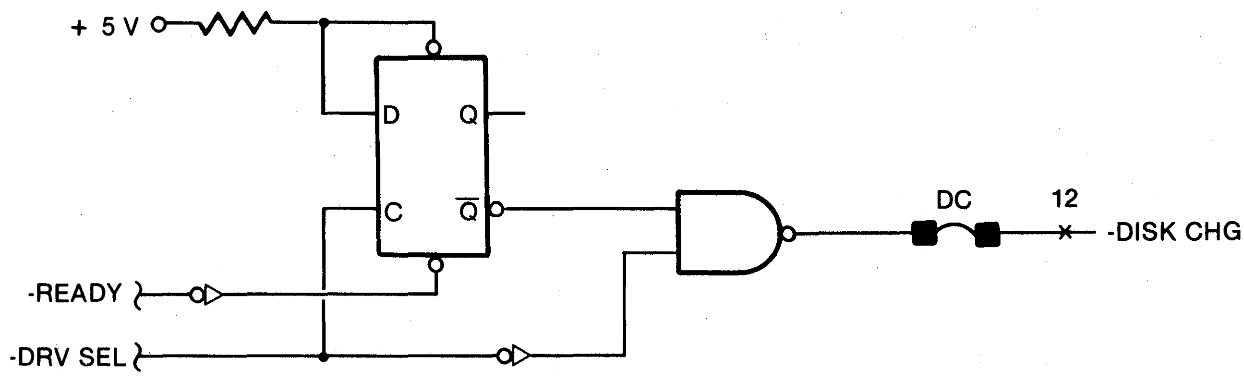
This customer installable option is enabled by jumpering trace DC. When DRIVE SELECT is activated, it will provide a true signal (logical zero) onto the interface (pin 12) if, while deselected, the drive has gone from a READY to a NOT READY (door open) condition. This line is reset on the true to false transition of DRIVE SELECT if the drive has gone READY. Timing of this line is illustrated in figure 7-4. The circuitry is illustrated in figure 7-5.



*READY will not return until two index transitions after DRIVE SELECT (MOTOR ON).

39216-22

FIGURE 7-4. DISK CHANGE TIMING

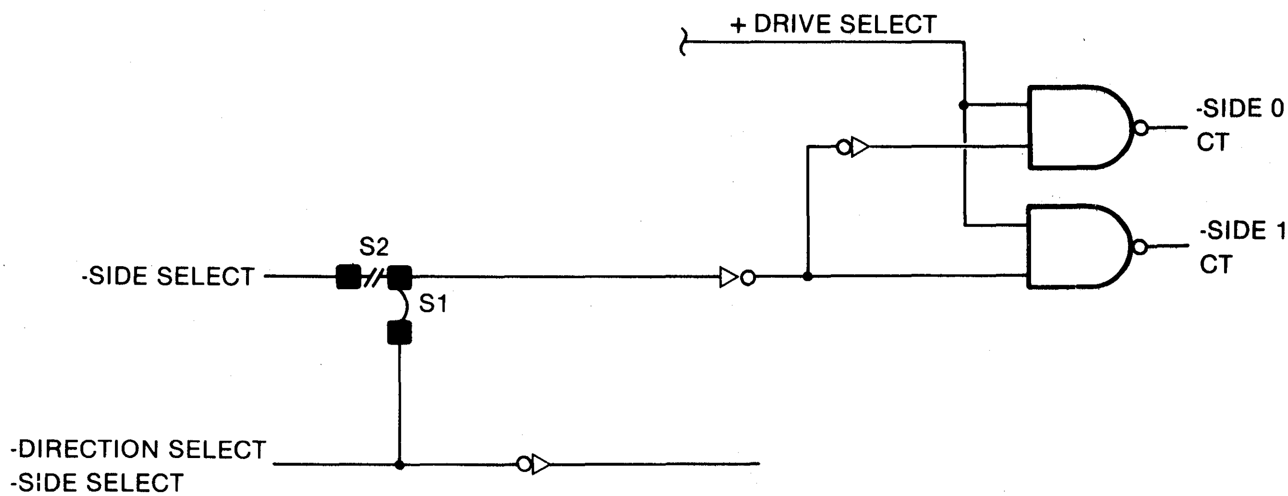


39216-23

FIGURE 7-5. DISK CHANGE CIRCUIT

7.5 SIDE SELECTION USING DIRECTION SELECT (SA860 ONLY)

The SIDE SELECT function can be controlled via the DIRECTION SELECT line, if desired. With this option, the DIRECTION SELECT line controls the direction of head motion during stepping operations and controls side (head) selection during read/write operations. To implement this option, simply move jumper S2 to location S1. Figure 7-6 illustrates the circuitry.



39216-24

FIGURE 7-6. SIDE SELECTION USING DIRECTION SELECT

7.6 SIDE SELECTION USING DRIVE SELECT (SA860 ONLY)

In systems containing no more than two SA860 drives per controller, each read/write head can be assigned a separate drive address. In such cases, the four DRIVE SELECT lines can be used to select the four read/write heads. To implement this option, move jumper S2 to S3 and add a jumper to nB (n = 1, 2, 3, or 4). For example, the first drive may have jumpers installed at DS1 and 2B while the second drive has jumpers at DS3 and 4B. With this jumper configuration installed, the four DRIVE SELECT lines have the following side selection functions:

a. DRIVE SELECT 1 selects side 0 of first drive.

b. DRIVE SELECT 2 selects side 1 of first drive

c. DRIVE SELECT 3 selects side 0 of second drive.

d. DRIVE SELECT 4 selects side 1 of second drive.

Figure 7-7 illustrates the circuitry.

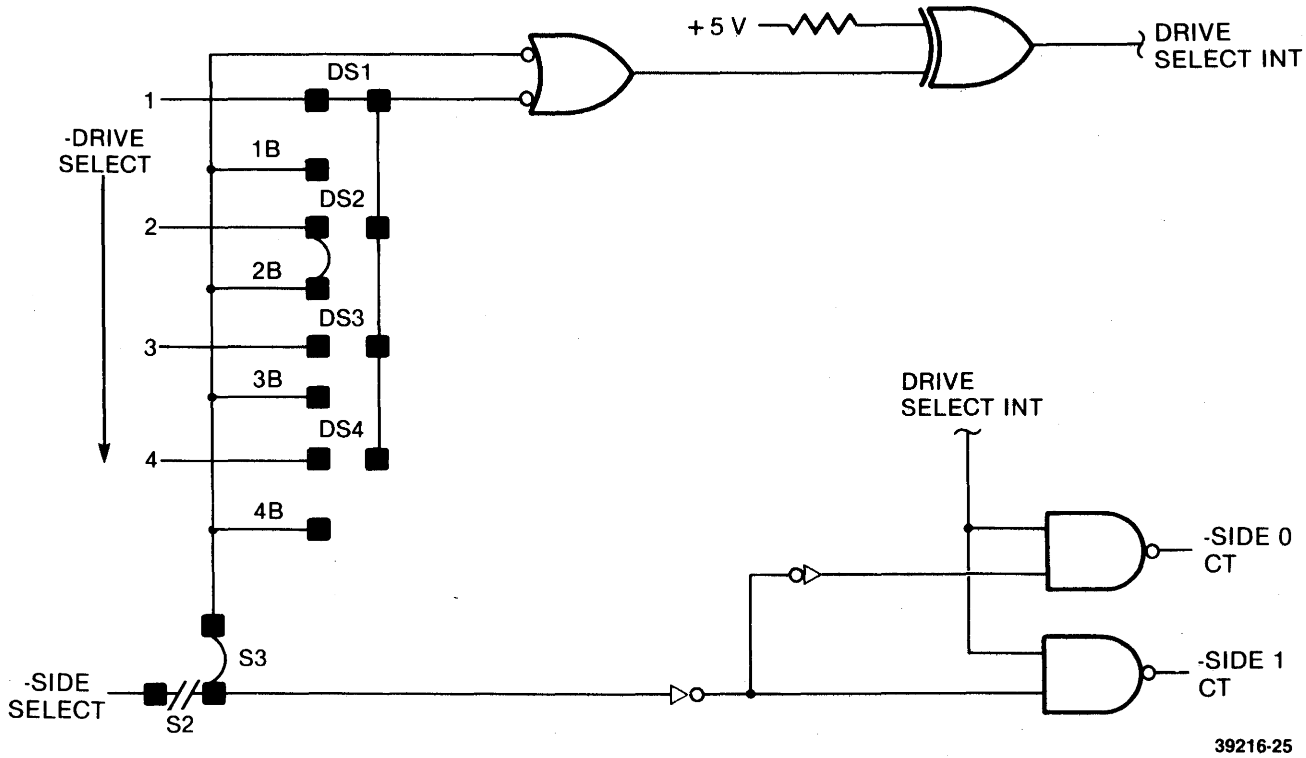


FIGURE 7-7. SIDE SELECTION USING DRIVE SELECT

7.7 IN USE ALTERNATE INPUT

This alternate input (pin 16) when activated to a logical zero level enables the Activity LED and door lock latch if the door is closed. If IN USE is low upon deselection, the door remains locked. If IN USE is high upon deselection, the door unlocks. To install this option, jumper trace D and move the shorting plug at trace Y to the Z position.

7.8 MOTOR ON WITHOUT SELECTING DRIVE

This option is useful in disk to disk copy operations. It allows the user to keep the motor on for all drives, thereby eliminating the motor start time. The motor is started on each drive via an Alternate I/O (pin 18). Each drive may have its own MOTOR ON line (Radial or Simplexed) or they may share the same line (Multiplexed). When the drive is selected, a 1 μs delay must be introduced or TRUE READY must be monitored before a read or write operation can be performed.
To install this option on a standard drive, move the shorting plug at trace MS to the MO position. See figure 7-8.

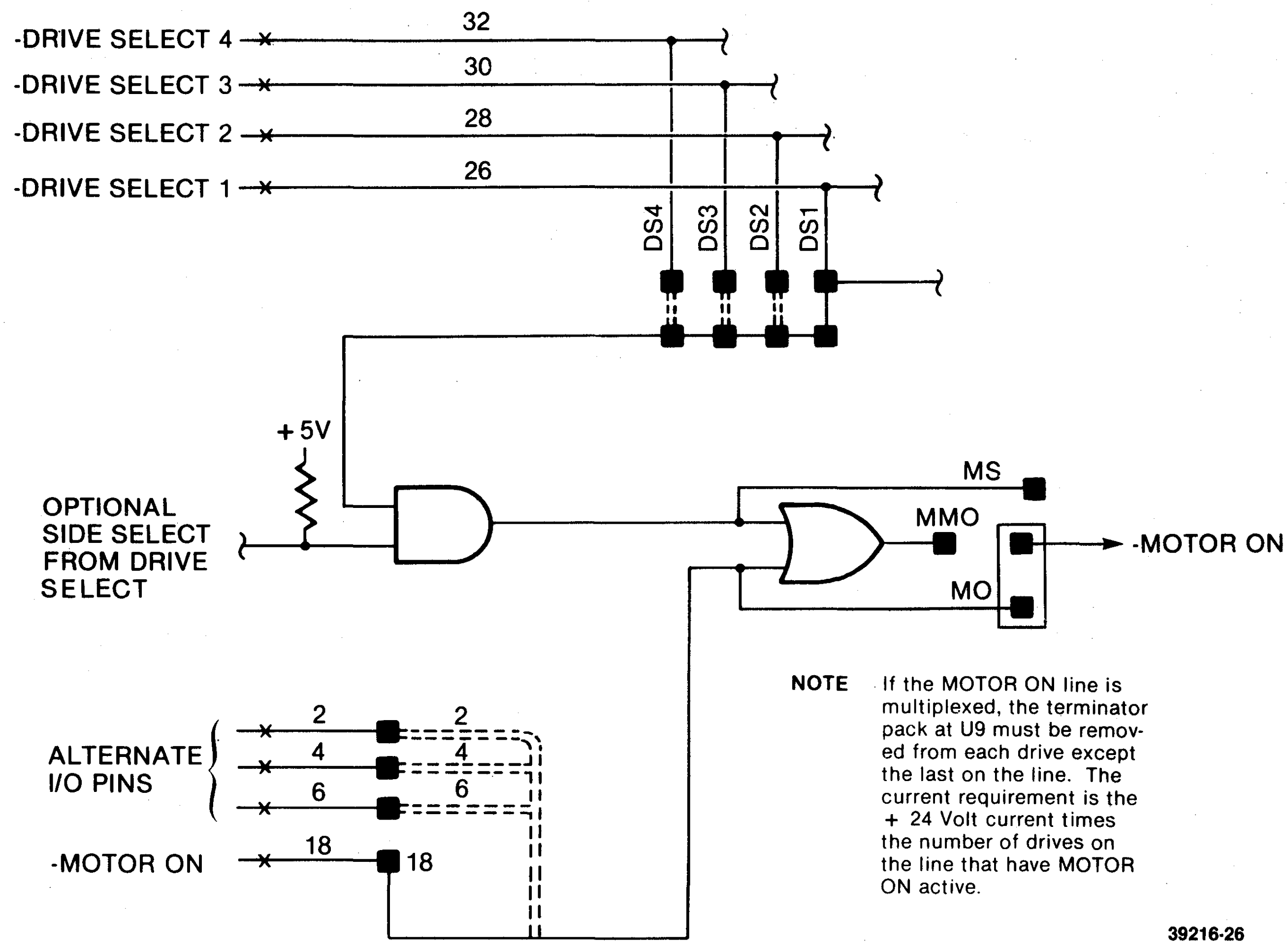


FIGURE 7-8. MOTOR ON WITHOUT SELECTING DRIVE CIRCUIT

7.9 MOTOR ON BY OPTIONAL MOTOR ON AND DRIVE SELECT

This option would be advantageous to the user who requires one drive to be selected at all times, but does not wish to keep the motor on for all drives. In this configuration, the dc spindle motor is controlled from DRIVE SELECT and the optional MOTOR ON line. The advantage of this option would be that the output control signals could be monitored without spinning the diskette thereby extending the head and media life. When the system requires the drive to perform a read or write , the controller would activate the MOTOR ON line (pin 18) which in turn would activate the spindle motor. After the MOTOR ON line is activated, a 165 ms delay must be introduced or the TRUE READY line must be monitored before a read or write operation can be performed.

To install this option on a standard drive, move the shorting plug at trace MS to the MMO position. Figure 7-9 illustrates the circuitry.

7.10 MOTOR OFF DELAY

This jumper option delays the spindle motor from turning off for 16 revolutions (2.6 seconds) after the DRIVE SELECT or optional MOTOR ON signal goes false (high). This allows the user to be able to read or write within 1 μs after the drive has been reselected, thereby eliminating the motor start time. This option is advantageous for the user who wishes to perform copy routines, but does not wish to use the optional MOTOR ON input signal.

To enable the MOTOR OFF DELAY on the standard drive, jumper trace MD.

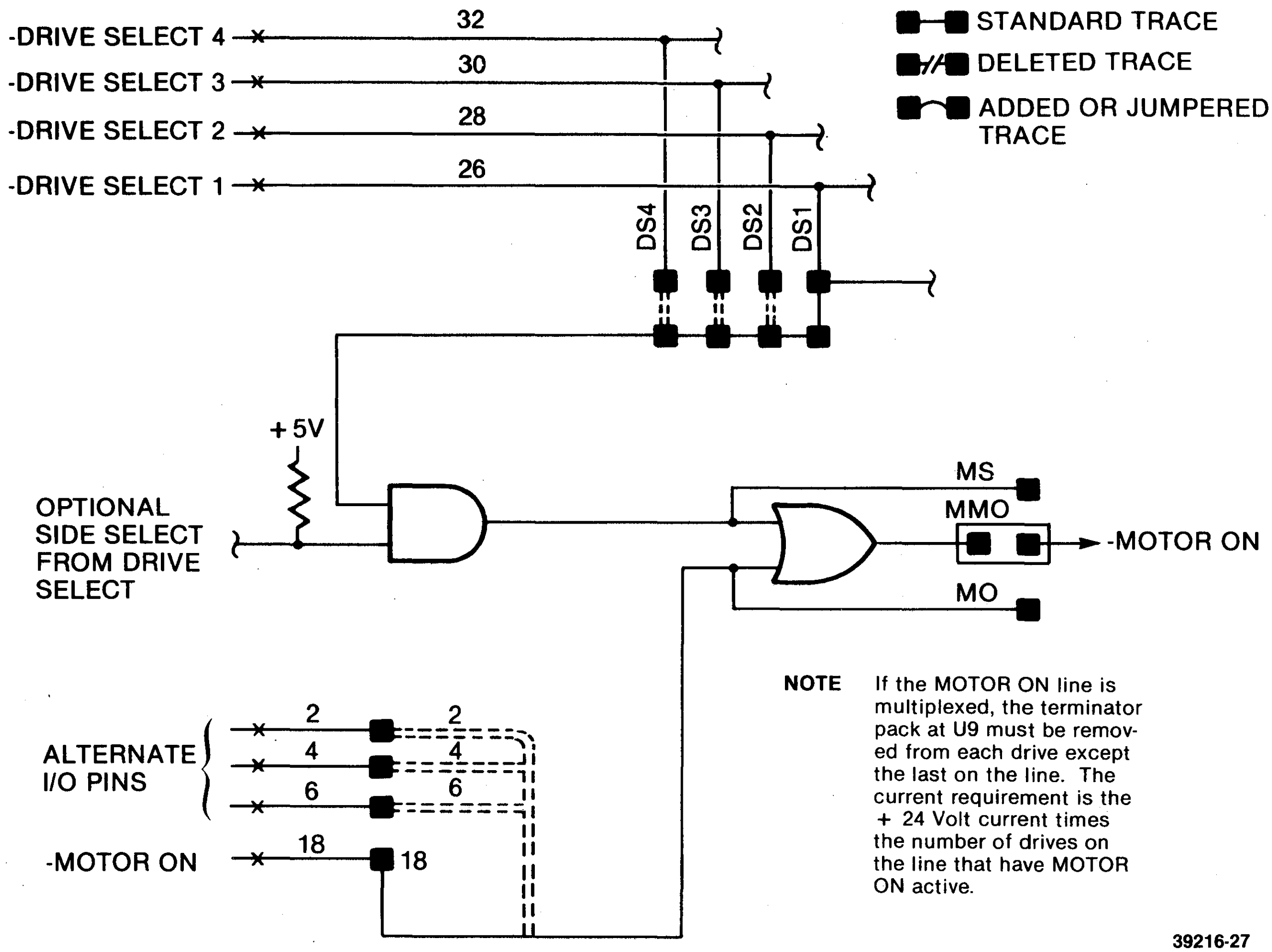


FIGURE 7-9. MOTOR ON BY OPT. MOTOR ON AND DRIVE SELECT CIRCUIT

7.11 RADIAL READY

This option enables the user to monitor the READY line of each drive on the interface. This can be useful in detecting when an operator has removed or installed a diskette in any drive. Normally, the READY line from a drive is only available to the interface when it is selected.

To install this option on a standard drive, the following traces should be deleted or added:

a. Cut trace RR.

b. Cut trace R.

c. Add a wire from R to one of the Alternate I/O pins.

NOTE

One of the drives on the interface may use pin 22 as its READY line, therefore steps b and c may be eliminated on this drive. All the other drives on the interface must have their own READY line, therefore steps b and c must be incorporated.

Figure 7-10 illustrates the circuitry.

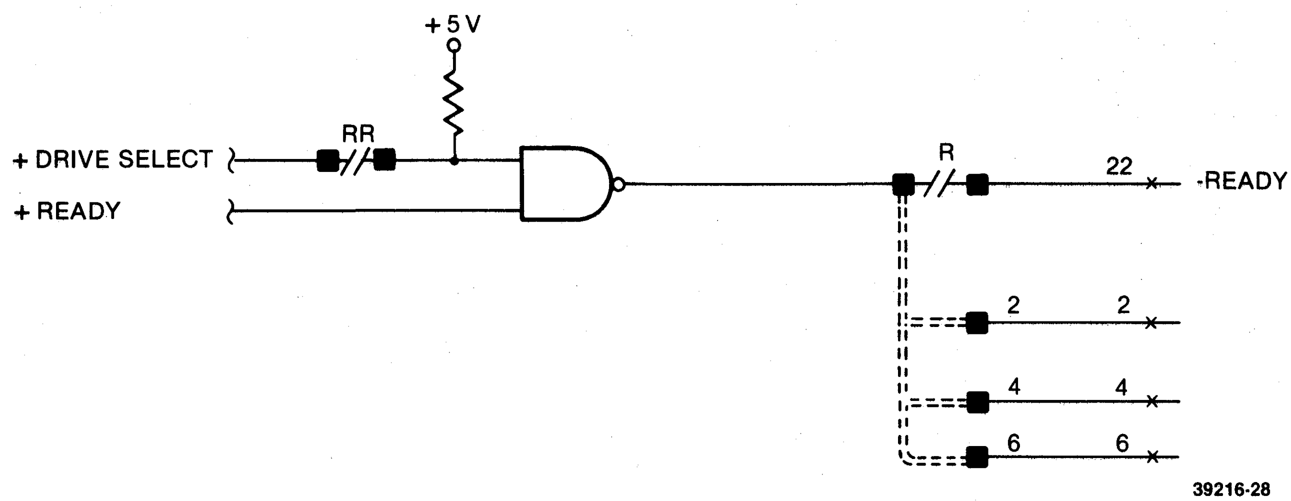


FIGURE 7-10. RADIAL READY CIRCUIT

7.12 STEPPER POWER DOWN

If the user wishes to step the drive at a step rate of 6 ms or slower, enabling this option will allow the drive to maintain a low noise emission level.

To install this option on a standard drive, jumper trace PD.

7.13 WRITE PROTECT OPTIONAL USE

As shipped from the factory, the write protect feature will internally inhibit writing when a write protected diskette is installed. With this option installed, a write protected diskette will'not inhibit writing, but it will be reported to the interface. This option may be useful in identifying special use diskettes.

To install this option on a drive with the write protect feature, the following traces should be added or deleted.

a. Cut trace WP.

b. Connect trace NP.

Figure 7-11 illustrates the circuitry.

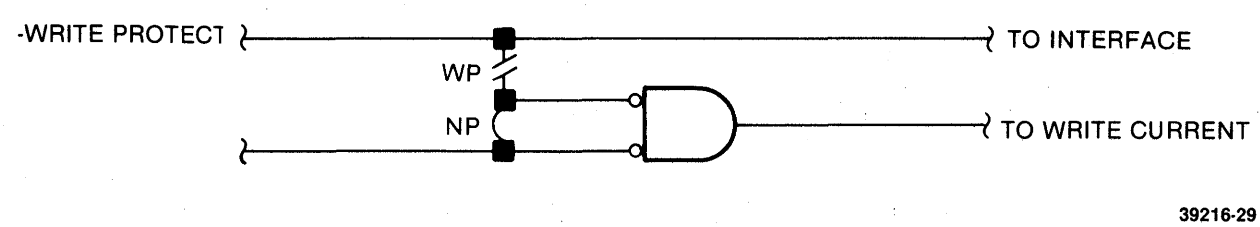


FIGURE 7-11. WRITE PROTECT CIRCUIT

SECTION VIII
OPERATION PROCEDURES

8.1 INTRODUCTION

The SA810/860 was designed for ease of operator use to facilitate a wide range of operator oriented applications. The following section is a guide for the handling and error recovery procedures on the diskette and diskette drive.

8.2 DISKETTE LOADING AND HANDLING

The diskette is a flexible disk enclosed in a plastic jacket. The interior of the jacket is lined with a wiping material to clean the disk of foreign material. Figure 8-1 shows the proper method of loading a diskette in the SA810/860 Diskette Storage Drive. To load the diskette, rotate the door knob clockwise and insert the diskette with the label facing the door knob. Rotate the door knob counter-clockwise to lock the diskette on the drive spindle. The diskette can be loaded or unloaded with all power on.

NOTE

The diskette cannot be removed when the activity light is lit. The activity light indicates that the door is locked.

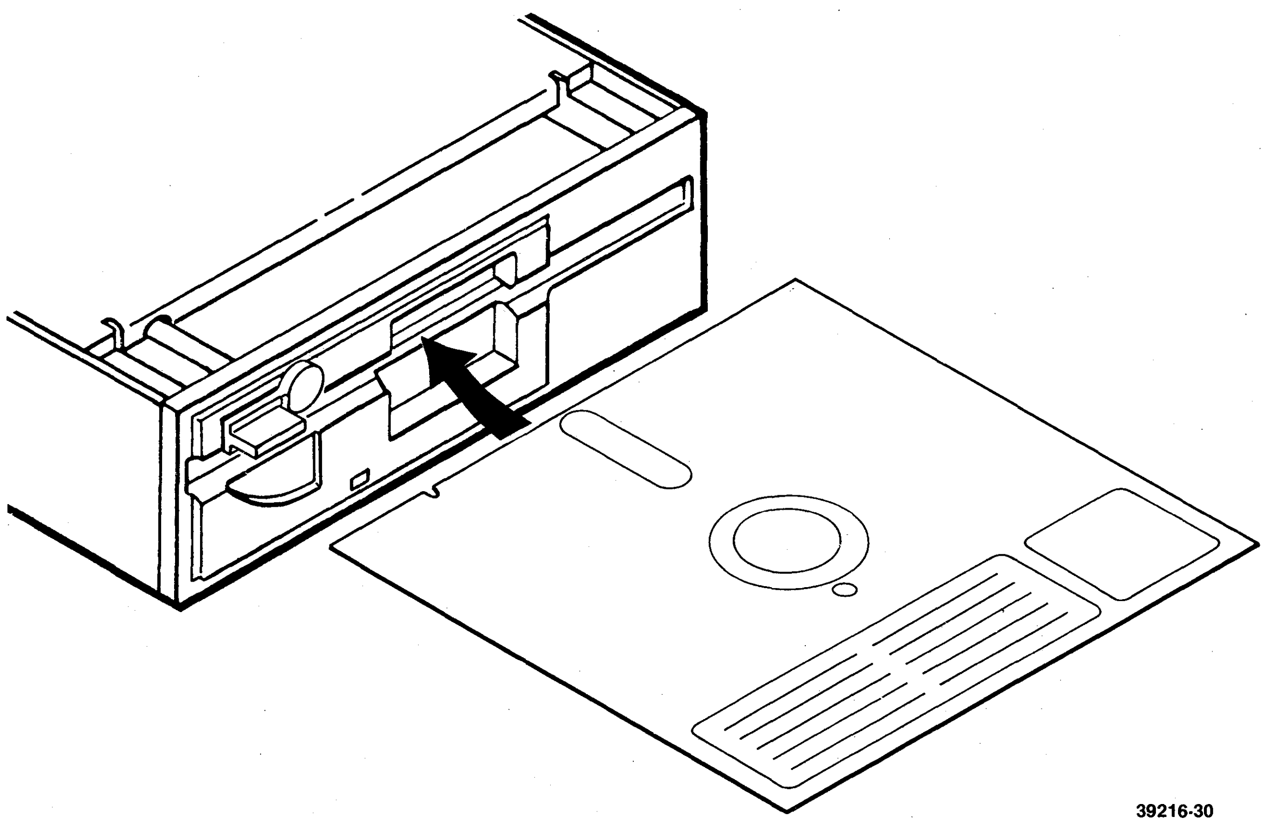


FIGURE 8-1. LOADING THE SA810/860

When removed from the drive, the diskette is stored in an envelope. To protect the diskette, the same care and handling procedures specified for computer tape apply. These precautionary procedures are as follows:

a. Return diskette to storage envelope whenever it is removed from drive.

b. Keep diskettes away from magnetic fields and from ferromagnetic materials which might become magnetized. Strong magnetic fields can destroy recorded data on disk.

c. Replace storage envelopes when they become worn, cracked, or distorted. Envelopes are designed to protect disk.

d. Do not write on plastic jacket with lead pencil or ball-point pen. Use felt tip pen.

e. Heat and contamination from carelessly dropped ashes can damage disk.

f. Do not expose diskette to heat or sunlight.

g. Do not touch or attempt to clean disk surface. Abrasions may cause loss of stored data.

8.2.1 Write Protect: Shugart 8-Inch Diskettes

The Shugart 8-inch diskettes have the capability of being write protected. The write protect feature is selected by the slot in the diskette. When the slot is open, it is protected; when covered, writing is allowed. The slot is closed by placing a tab over the front of the slot, and folding the tab over to cover the rear of the slot. The diskette can then be write protected by removing the tab. See figure 8-2.

8.2.2 Write Protect: IBM Diskettes

IBM diskettes are not manufactured with a pre-punched write protect slot.To write protect one of these diskettes, a slot must be punched out as specified in figure 8-3. The operation of the write protect is that which is outlined in paragraph 2.2.20.

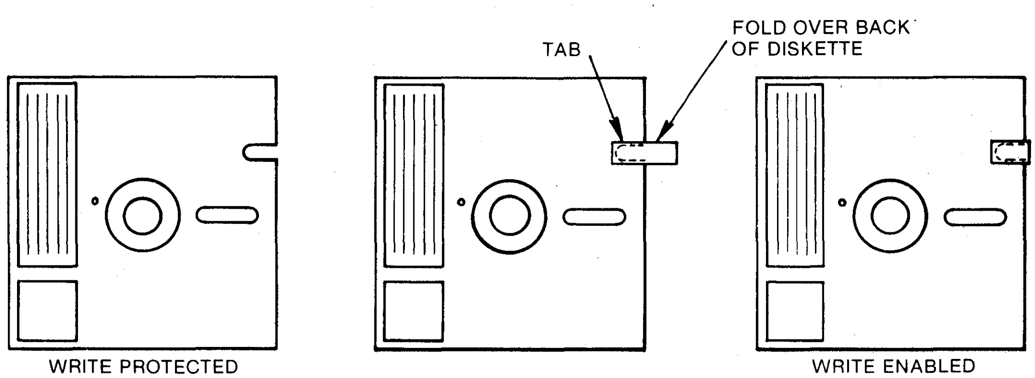


FIGURE 8-2. DISKETTE WRITE PROTECT

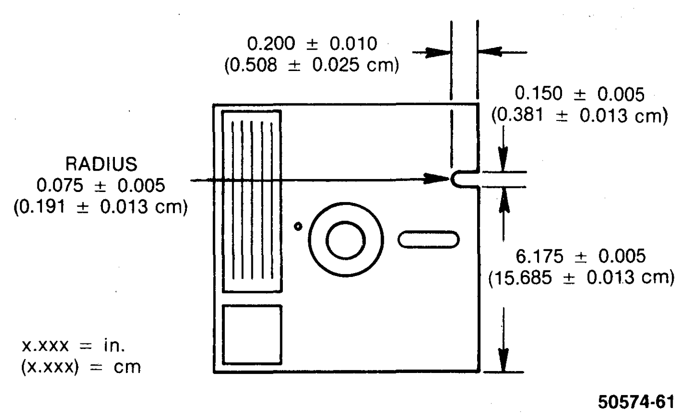


FIGURE 8-3. WRITE PROTECT NOTCH SPECIFICATIONS

SECTION IX
PACKAGING

It is suggested that packing material be kept in case the unit must be returned to Shugart for repair. Regardless, the unit must be individually packaged in comparable packing as shipped to preclude damage in shipping and handling. **Damage to the unit as a result of inadequate packaging will void the warranty on the unit.**

Figure 9-1 shows how to repackage the disk drive using the original shipping containers. Figure 9-2 illustrates the pallet pattern and the maximum pallet size to use if reshipped in large quantities.

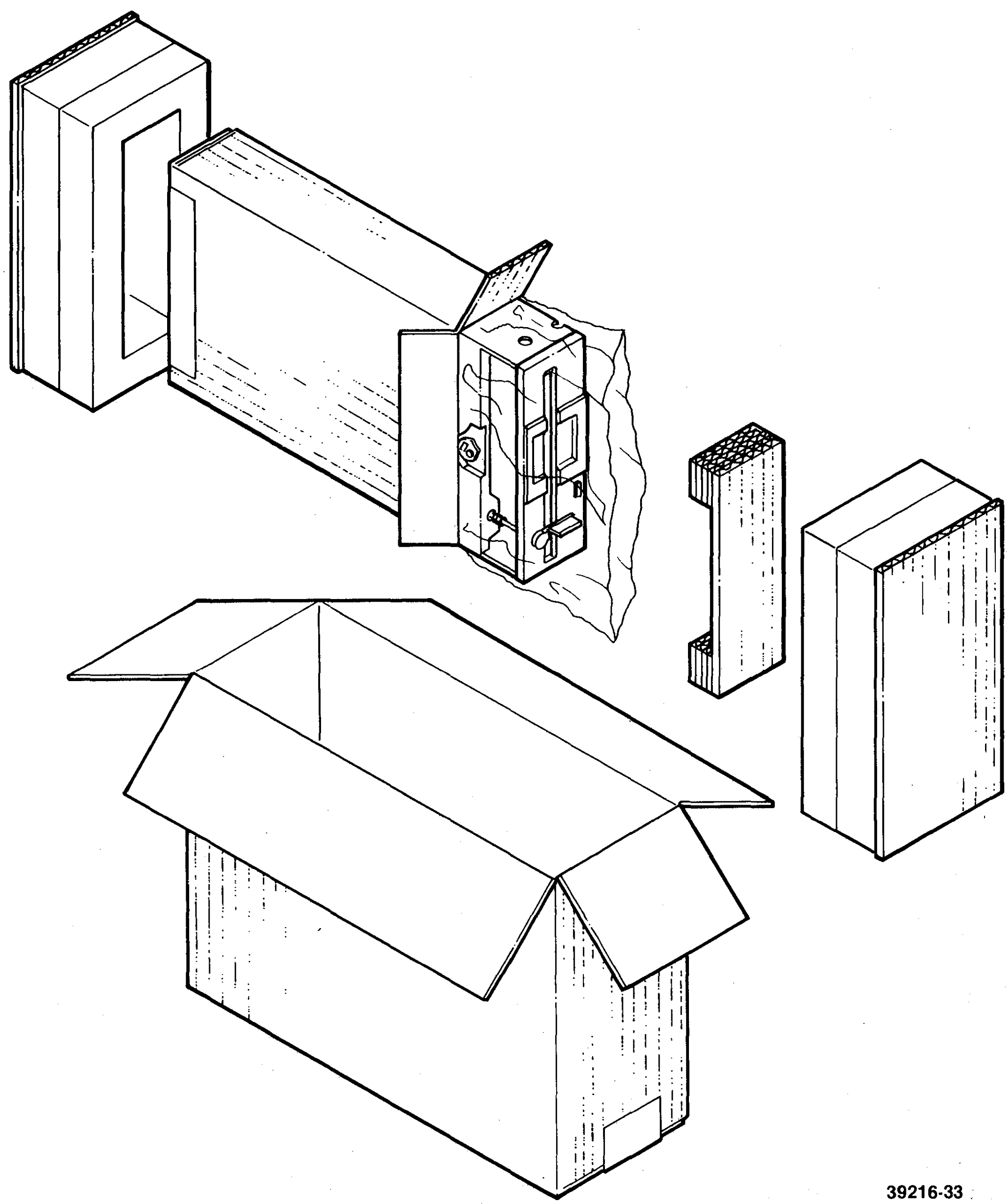


FIGURE 9-1. SA810/860 PACKAGING

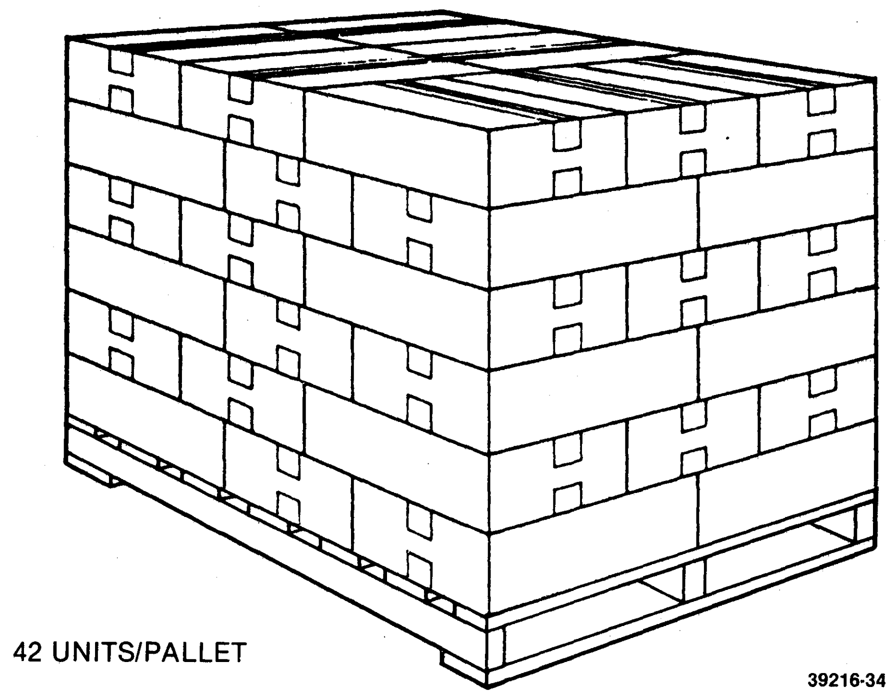


FIGURE 9-2. PALLET LOADING

APPENDIX A
MACHINE LEVEL CODE INFORMATION

Table A-1 identifies distinct features or exceptions to the general description of the SA810/860 in this manual.

TABLE A-1. MACHINE LEVEL CODE INFORMATION

MLC NUMBER	DESCRIPTION
0	THE WORST CASE MOTOR START TIME IS 220 ms. THE MULTIPLEXED MOTOR ON LINE OPTION IS NOT AVAILABLE. BUFFERED SEEK IS NOT INCLUDED. TRUE READY IS INVALID FOR THE PURPOSE OF MOTOR-UP-TO-SPEED. JUMPERS RTR, MMO, SR, MT, Y AND Z ARE NOT INCLUDED. THE FACEPLATE AND KNOB DESCRIBED IN THE SA810/860 OEM MANUAL 39216-0 IS INCLUDED.
1	SAME AS MLC 0 EXCEPT THAT THE FACEPLATE AND KNOB ARE AS DESCRIBED IN THIS MANUAL.
2	SAME AS MLC 1 EXCEPT THAT STATIC CLAMPING AND PCB 25247 ARE INCLUDED.

39216-32

APPENDIX B
ORDERING INFORMATION

Table B-1 can be used to construct a part number for a unique drive configuration.

TABLE B-1. SA810/860 ORDERING INFORMATION

SA810

A B C D E F

AB	PRODUCT LINE	C	OPTION	D	MODEL	E	OPTION	F	OPTION
68	810	0	NONE	1	810	0	NONE	0	NONE

SA860

A B C D E F

AB	PRODUCT LINE	C	OPTION	D	MODEL	E	OPTION	F	OPTION
69	860	0	NONE	1	860	0	NONE	0	NONE

39224-06

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